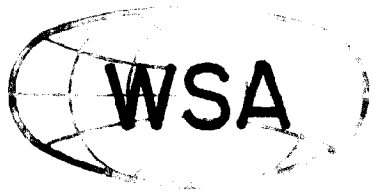

A STUDY OF THE SHOREFRONT PROPERTY ALONG THE THAMES RIVER GROTON, CONNECTICUT

Wilbur Smith and Associates

A STUDY OF THE SHOREFRONT PROPERTY ALONG THE THAMES RIVER

prepared for the

TOWN OF GROTON

by

Wilbur Smith and Associates

MARCH 1984

Wilbur Smith and Associates, Inc.

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CABLE WILSMITH
TELEX 57-3439

March 27, 1984

Mr. Mark Oefinger, AICP
Director of Planning
Town of Groton
45 Fort Hill Road
Groton, Connecticut 06340

Dear Mr. Oefinger:

We are pleased to submit our final report entitled "A Study of the Shorefront Property Along the Thames River, Groton, Connecticut".

The report has analyzed various development options and the benefits, constraints and feasibility associated with each option. As a result of the study, the following development schemes were brought forward:

- Scheme 1 - A linear park consisting of overlooks, jogging trails and picnic areas;
- Scheme 2 - A more extensive linear park consisting of overlooks, jogging trails, picnic areas and a shoreline boardwalk; and,
- Scheme 3 - Additional development of Scheme 2 with improved parking facilities, access and direct use of the river by means of small docks and fishing piers.

Working in conjunction with the Nautilus Memorial project and the City of Groton's Thames Street development project, the Thames River shorefront has the potential of being an integral part of a new theme with added recreational attractions for tourists and local residents.

We hope that this report will be of assistance to the Town of Groton in making future decisions regarding the development along the Thames River. If you have any questions or if we can be of further assistance, please do not hesitate to contact our office.

Very truly yours,

WILBUR SMITH AND ASSOCIATES

Jonathan L. Feinstein
Environmental Planner

JLF/ca
Enclosures

TOWN OF GROTON, CONNECTICUT

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C. Richard Foote

This document was financed in part by a grant through the Office of Coastal Zone Management, National Oceanic and Atmospheric Administration of the U.S. Department of Commerce under the Coastal Zone Management Act of 1972, and was prepared in cooperation with the Connecticut Department of Environmental Protection's Coastal Area Management Program.

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EXECUTIVE SUMMARY

A study was conducted along the Thames River in Groton to evaluate options to maximize the coastal resources for the use of Groton residents and visitors to the area. The following goals were established.

1. To identify development scenarios for the site and describe suitable uses and activities which may take place at the site.

2. To initiate a long term program of increasing public access along the shorefront.

3. To provide conceptual and/or physical linkage of the Thames Street area, Military Highway and the proposed Nautilus Memorial.

4. To insure that the use and development of the site is consistent with state coastal policies and guidelines.

5. Provide public access to the shorefront for fishing, walkways, bikepaths, parks, and other recreational uses.

6. To enhance the visual and aesthetic appeal of the shorefront from land and water.

7. To incorporate improvements to the transportation network of the area into potential site development.

The environmental constraints present in Groton and the terrestrial and aquatic environments were assessed in order that development schemes would be compatible. Three schemes were proposed for the area as follows:

- Scheme 1 - Proposed scenic overlooks and jogging path;
- Scheme 2 - Proposed scenic overlook and picnic areas; and,
- Scheme 3 - Proposed locations for alternative recreation/ marine uses and overlooks.

Funding strategies can be developed to help phase specific elements of the schemes in order to provide more immediate improvements to the shoreline.

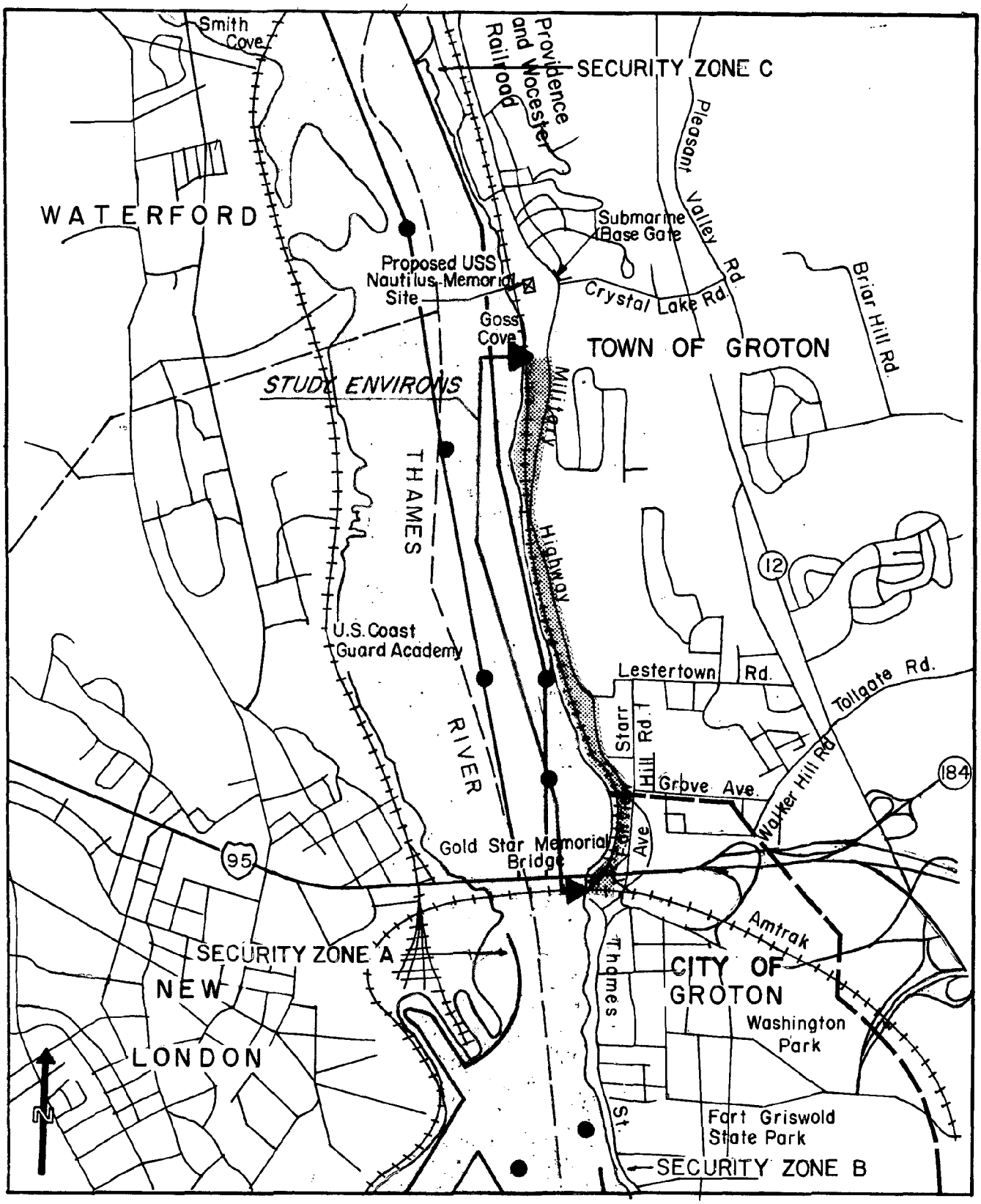
Chapter I
STUDY GOALS AND OBJECTIVES

The following chapter describes the purpose and objectives of the study.

This study was designed to assess new options for better utilization of the shoreline which is generally unaccessible along the Thames River from the Gold Star Bridge (I-95) to the U.S. Submarine Base.(Figure 1). The study is being funded under the State Coastal Area Management Program. The study has been geared to evaluate alternatives which can accommodate the needs of Groton residents while at the same time considering the potential of the Nautilus Memorial and Submarine Museum at Goss Cove. The Nautilus Museum could be one of the largest and most significant tourist attractions in the State in recent years. There has been a strong showing of support for the project by both private and public agencies. A five million dollar bond has been passed by the State of Connecticut for construction and a fall (1984) date for ground-breaking is anticipated.

The study site was initially examined under the Municipal Coastal Program and was recommended for a feasibility study of water oriented uses. The study is consistent with the policies and regulations set forth in the Connecticut Coastal Area Management Program, as well as the Municipal Coastal Program of the Town of Groton. The City of Groton has completed a study of Thames Street within its limits to improve the attractiveness and appeal of the area for residents and tourists. The shorefront study of the Thames River is compatible with, and complementary of, the City's plans for enhancement of Thames Street and the local environs.

The goals for the study were developed through joint coordination with the Town of Groton. These goals and objectives are as follows:



LOCATION MAP

SCALE 1" = 2000'

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FIGURE 1

1. To identify development scenarios for the site and describe suitable uses and activities which may take place at the site.

2. To initiate a long-term program of increasing public access along the shorefront.

3. To provide conceptual and/or physical linkage of the Thames Street area, Military Highway and the proposed Nautilus Memorial.

4. To insure that use and development of the site is consistent with state coastal policies and guidelines.

5. Provide public access to the shorefront for fishing, walkways, bikepaths, parks, and other recreational uses.

6. To enhance the visual and aesthetic appeal of the shorefront from land and water.

7. To incorporate improvements to the transportation network of the area into potential site development.

8. To identify potential sites for dredged fill containment.

The availability of coastal access for recreation and development has become an important issue for communities situated along the coast. The marine environment provides both an active and visual attraction for residents as well as visitors. Residents enjoy living along the coast where the climate is generally cooler, and the atmosphere is more relaxed and private. Visitors enjoy the active benefits which typically include sightseeing, boating, bathing, and other activities.

The coastline of the Thames River in Groton illustrates the concept of multiple use by allowing active uses such as commercial, industrial, transportation, recreation and incorporating other passive activities which have become a cost to residents. Because of the steep slopes along the river, most activities have become dependent upon upland areas for their conters of operation. However, selected areas have enough land to allow specific activities to be developed.

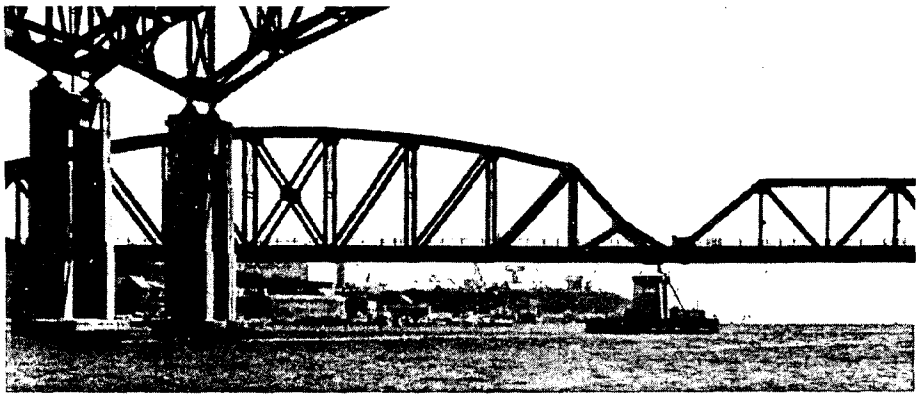
This report has identified specific areas of constraint as well as presented fresh ideas for enhancement of this shoreline.

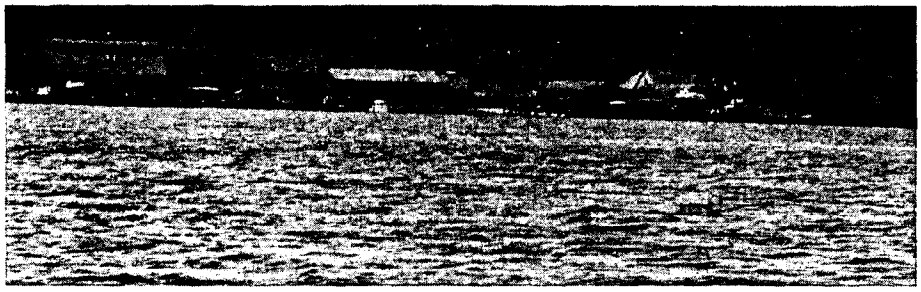
Chapter II
STUDY AREA DESCRIPTION

This chapter provides a description of the study area and the inherent physical constraints which are evident. The length of the study area is approximately 9,000 feet (from the Gold Star Bridge to Crystal Lake Road) with an average width of 160 feet. The widest section of land is approximately 270 feet with the narrowest portion at 90 feet. The total area is about 33 acres.

The Thames River has many functions which serve both the recreational user as well as various commercial enterprises. There are many significant uses which are water dependent and contribute significantly to local and state economies. Figure 2 illustrates some of the water related uses including a small marina and (shown in the top photograph in the distance) the General Dynamic Electric Boat facility. Not shown in this figure, but equally important, is the U.S. Naval Submarine Base which is at the northern limits of the study area. From a land use standpoint there are only two residential structures located within the study area (see Figure 3). These houses presently enjoy an unobstructed view of the river and are carefully situated on the edge of the hillside. The Whaling City Dredge and Dock Corporation located near the Gold Star Bridge (see Figure 2) has optimized their coastal location and effectively is a major user of the coastal shore in this stretch of the river.

From a visual and aesthetic point of view the study area offers a pleasant perspective from both the water and the roadway. Figure 4 shows (the upper photograph) that dense vegetation covers the hillside and an undeveloped view is given for this part of the river. This can be considered as a positive benefit for boaters as well as providing valuable cover to prevent erosion and deterioration of the severe slopes. The lower photograph on the same figure illustrates the proximity of the railroad to the water's edge.





WATER DEPENDENT USES ALONG THE THAMES RIVER

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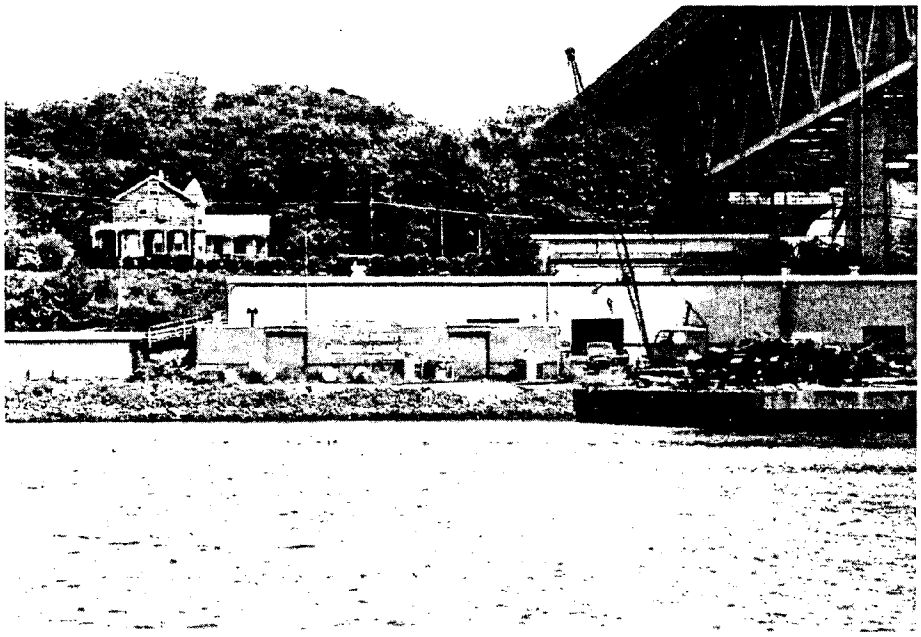
FIGURE 2

RESIDENTIAL USES ALONG THE RIVER



COMMERCIAL USE

LAND USE ALONG THE THAMES RIVER STUDY AREA

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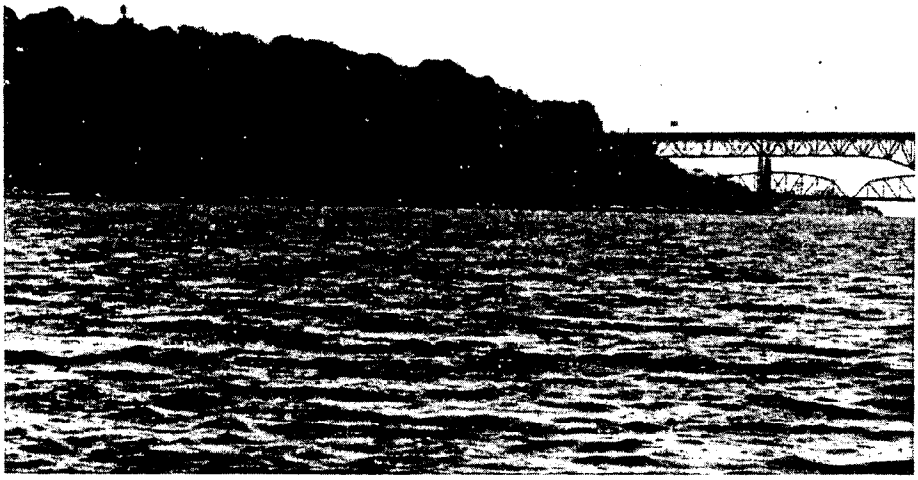
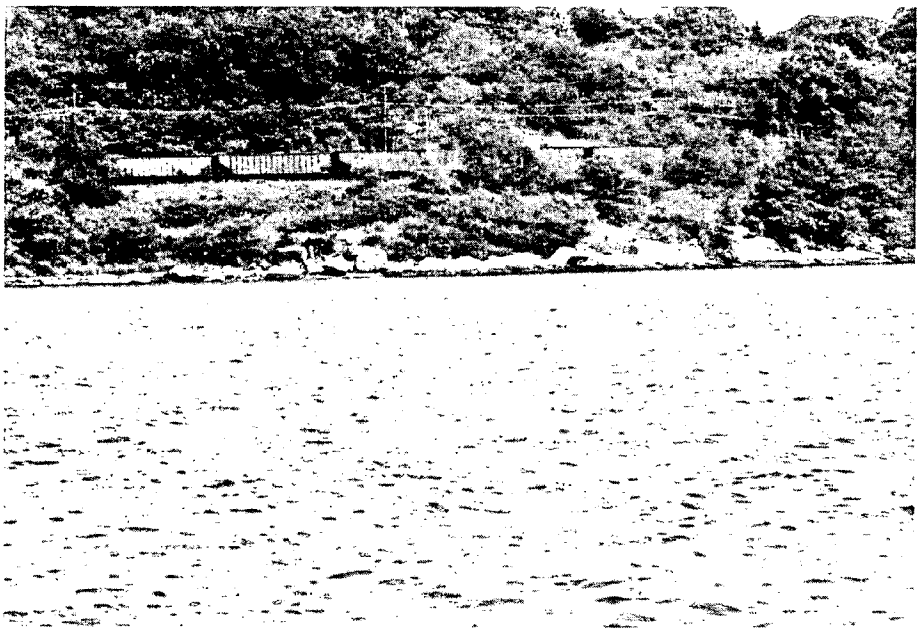
FIGURE 3





LANDSCAPE CONDITIONS ALONG
THE STUDY AREA

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FIGURE 4

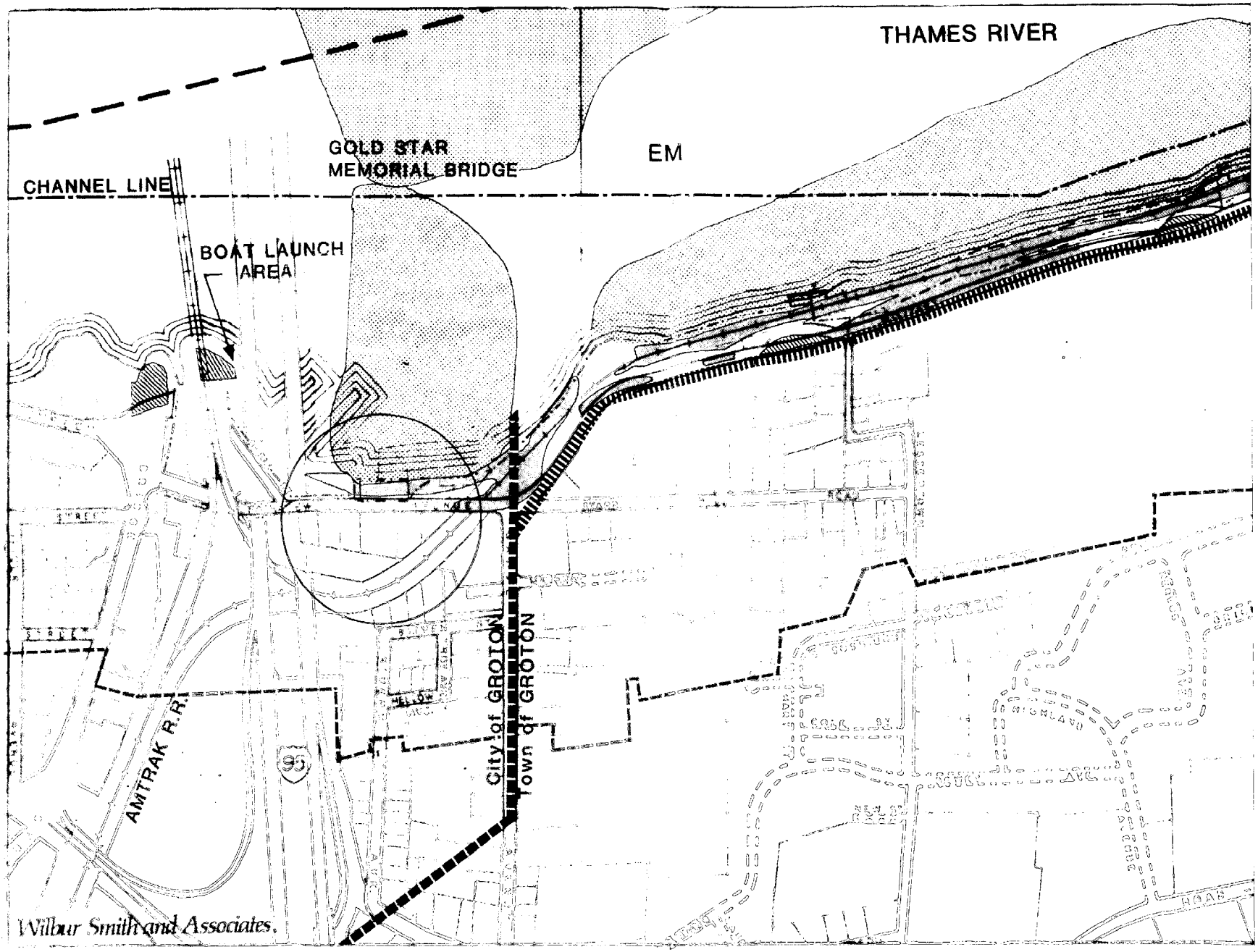
Once the plans for the Nautilus Museum are finalized there may be opportunities available to enhance rail oriented access to selected points along the river.

II.1 Physical Constraints

A constraint can be considered as an ecological, physical, and/or institutional factor which limits development or other activities from taking place. The specific categories of constraints discussed in this chapter include: physical, ecological, transportation, and administrative/regulatory controls.

A broad overview of these major constraint categories is pictorally represented in Figure 5. Such physical features as excessive slopes are found to be a major limiting factor in determining the types of development which are appropriate for the study area. The location of the Providence and Worcester Railroad and Military Highway also puts an additional restriction on where possible site developments can take place, as well as the availability of suitable access to these proposed recreational alternatives. Other environmental concerns are the abundant beds of shellfish located along the waterfront area in protected coastal waters. All of these factors have a bearing on the type of development which will allow for the greatest utilization of the recreational and tourist related opportunities available without causing unnecessary alternations to the environment.

The most striking feature of the study area are the steep slopes which are present along the entire stretch of the shoreline. From the intersection of Grove Avenue and Starr Hill Road and Fairview Avenue to Burgeville Court, the topography is severe west of the railroad tracks with most of the land averaging slopes


THAMES RIVER
GOLD STAR
MEMORIAL BRIDGE
EM
CHANNEL LINE
BOAT LAUNCH
AREA
AMTRAK R.R.
City of GROTON
Town of GROTON
95
Wilbur Smith and Associates.

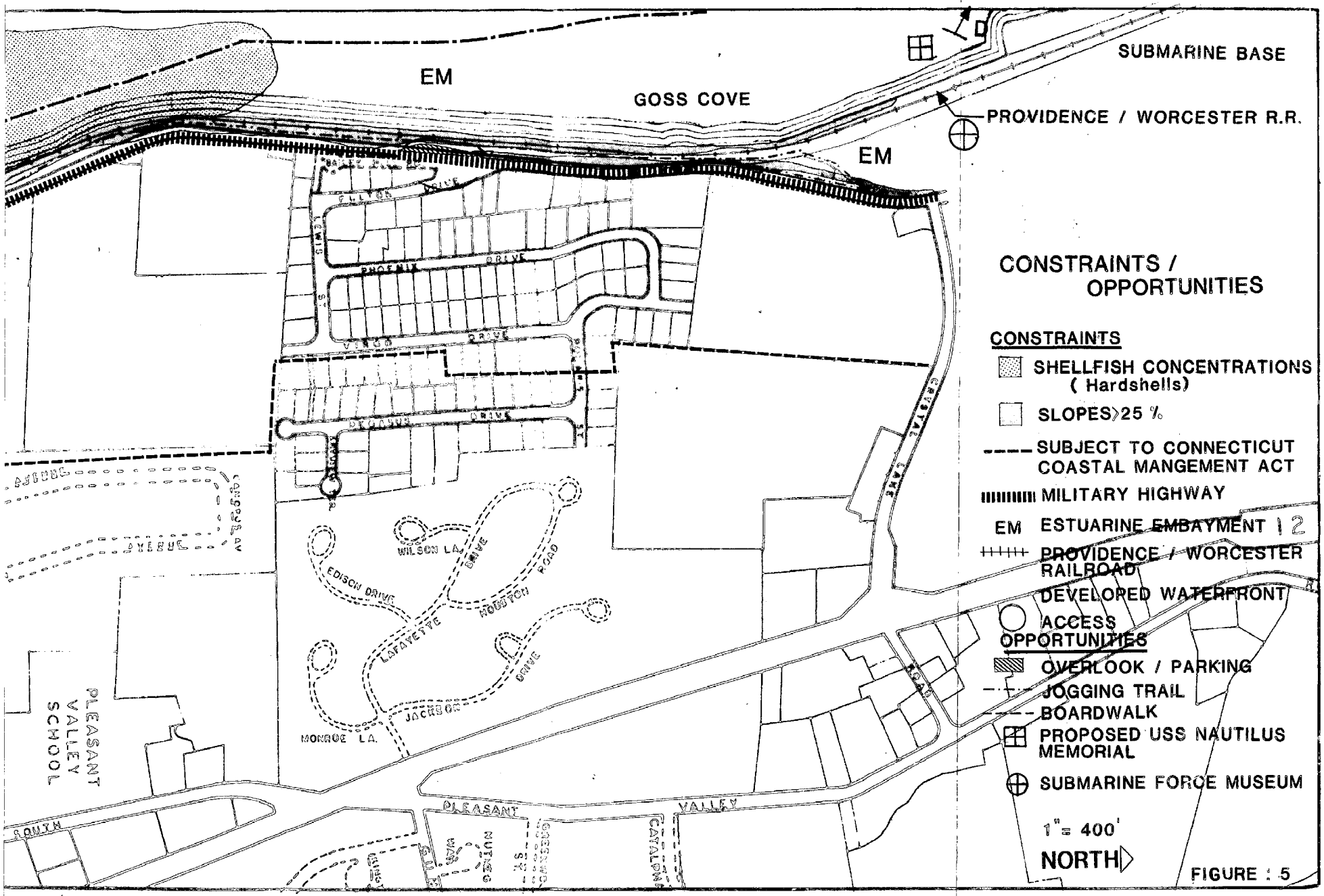
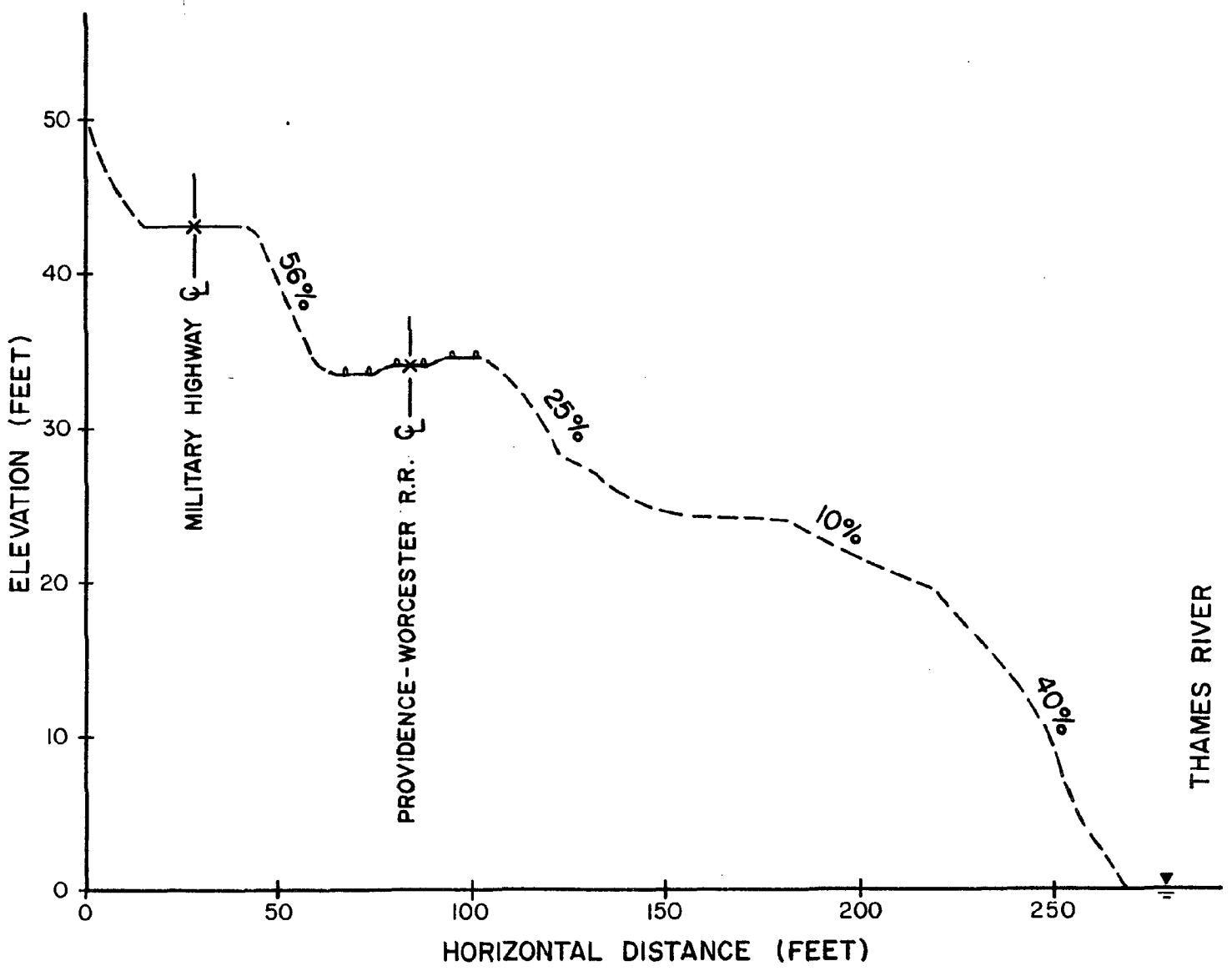

EM
GOSS COVE
SUBMARINE BASE
PROVIDENCE / WORCESTER R.R.
EM
PHOENIX DRIVE
EDISON DRIVE
WILSON LA.
DRIVE
HOUSTON ROAD
LAFAYETTE
DRIVE
JACKSON
MONROE LA.
PLEASANT VALLEY SCHOOL
PLEASANT
VALLEY
ROAD
CATALPA
CONSTRAINTS / OPPORTUNITIES
CONSTRAINTS
SHELLFISH CONCENTRATIONS (Hardshells)
SLOPES>25 %
SUBJECT TO CONNECTICUT COASTAL MANGEMENT ACT
MILITARY HIGHWAY
EM ESTUARINE EMBAYMENT
PROVIDENCE / WORCESTER RAILROAD
DEVELOPED WATERFRONT
ACCESS
OPPORTUNITIES
OVERLOOK / PARKING
JOGGING TRAIL
BOARDWALK
PROPOSED USS NAUTILUS MEMORIAL
SUBMARINE FORCE MUSEUM
1" = 400'
NORTH

FIGURE : 5

of 50 percent or greater. East of the railroad tracks the topography is less drastic with most of the topography at less than 25 percent slope. Opposite Burgeville Court a point of land juts out approximately 150 feet from the edge of the track to the river. This land area has an average slope of less than 25 percent and can be considered one of the more optimistic locations for potential use along the coastline. The land eastward to Lestertown Road is less steep than the property westward and adjacent to the river which exceeds 50 percent slope. From Lestertown Road to Lewis Street, the study area parallels Military Highway in a linear band of narrow and steep areas on both sides of the tracks. More usable areas for visual pulloffs and access appear on the easterly side of the track, while the land on the west of the track is predominated by steep and irregular slopes. From Lewis Street to the northern end of the study area pockets of flat land exist on the landward side of the track, but for the most part are isolated between areas which are steep and unaccessible. Figures 6 and 7 depict specific locations and their topography. From both illustrations it can be seen that the Providence and Worcester Railroad effectively bisects the coast and prohibits access to the water. They also show that usable space is scarce, and where it is present it is isolated.

II.2 Ecological Resources

II.2.A Fishery Resources - The fishery resources endemic to the Thames River are attributed to the abundance and diversity of species in the Long Island Sound. It has been determined from previous studies that tautog and blackback flounder are the only commercially important fish species known to be in the Sound year round. The State of Connecticut maintains logbook statistics on catch data for Long Island Sound and divides the shoreline into



TOPOGRAPHIC CROSS SECTION 670' NORTH OF FAIRVIEW AVE. RAILROAD OVERPASS

FIGURE 6

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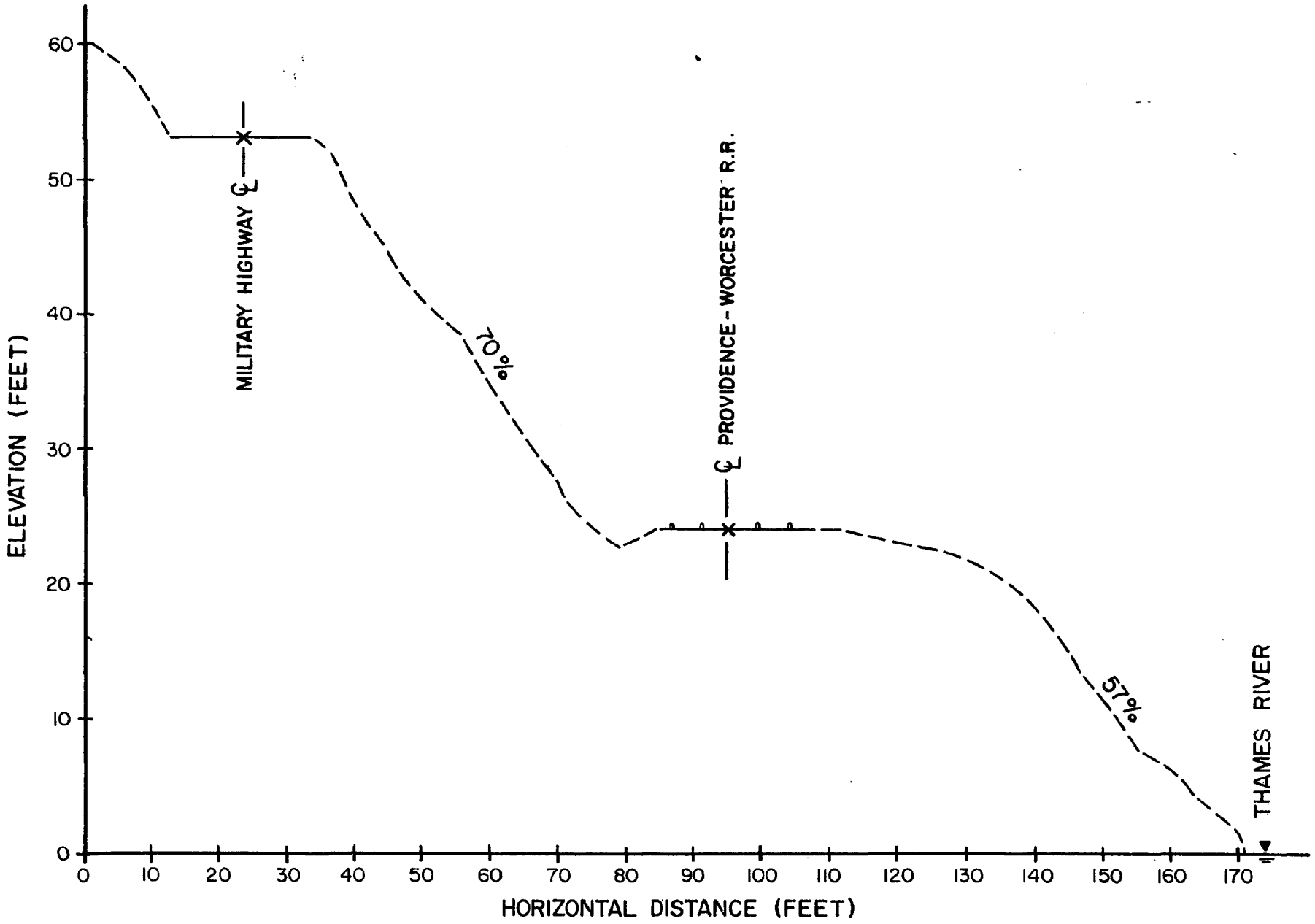


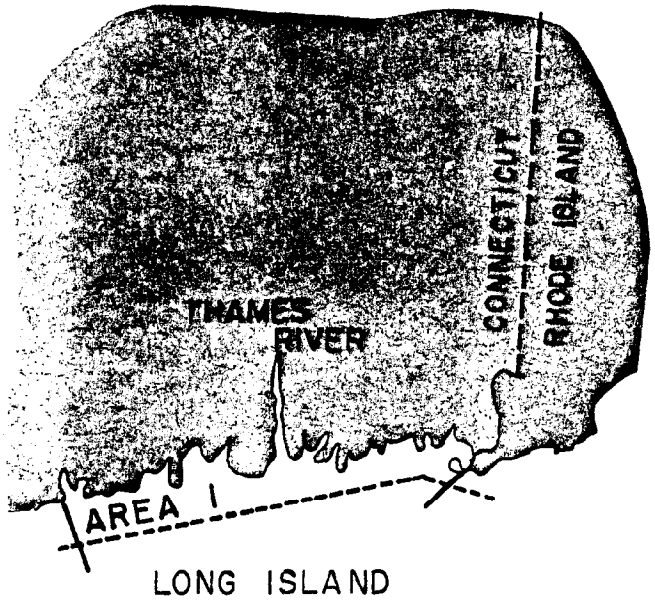
TOPOGRAPHIC CROSS SECTION 150' SOUTH
OF MILITARY HIGHWAY - LESTERTOWN ROAD INTERSECTION

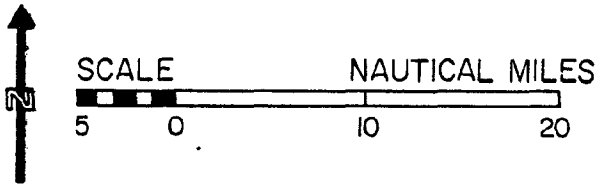
Wilbur Smith and Associates

FIGURE 7

eight areas. The Thames River is associated with area 1 as shown on Figure 8. Table 1 enumerates 21 fish species and their dollar value. This survey shows that lobsters contribute the most to the economy while flounder provides the second most important catch. Tautog, previously stated, is an important commercial species absent from this list. It can be assumed from other records that the tautog is a popular fish and its importance is greater for local demands rather than export business.

The Environmental Assessment prepared for the USS Nautilus Memorial and Submarine Force Museum, reports that a total of 61 migrant and resident fish species have been recorded, of which 57 use the Long Island Sound area as spawning grounds. The area from the Coast Guard Academy to Goss Cove is known to be a nursery area for blackback flounder (P. Minta, 11 March 1983). It has been reported that anadromous fish using the Thames River include sea run brown trout, American shad, rainbow smelt, white perch, striped bass, alewife and glut herring. The Thames River estuary has specific areas of shellfish abundance with most extensive beds located along the western side of the river from the U.S. Coast Guard Academy in New London south to Goshen Point. These beds are predominated by hard clam (Mercenaria mercenaria) and are prolific because of the many coves and inlets which are evident along the river. The eastern side of the river (along the study area and south) has a more linear coastline with fewer harbors and coves. Pockets of hard clam beds can be found, with two noticeable in the study area. The first is in a shallow cove north of the Gold Star Memorial Bridge and extends almost midway into the Thames River Channel. The second area is a linear group starting at Bailey's Point and extending an estimated 4,700 feet south. Although the estuary is closed to shellfish harvesting to the mouth of the river, it provides a significant source of shellfish for recreational and commercial fishing.





LONG ISLAND SOUND
FISHING AREA #1

SOURCE: DRAFT ENVIRONMENTAL IMPACT STATEMENT
TRIDENT DREDGING; THAMES RIVER CHANNEL
GROTON & NEW LONDON, 1979

Wilbur Smith and Associates

FIGURE 8

Table 1

VALUE OF FISH (DOLLARS) LANDED

1-78 THROUGH 6-30-78

SPECIES	VALUE
Anglerfish	-
Blackfish	8
Butterfish	-
Cod	-
Dogfish	-
Eels	4
Flounder	3,963
Herring	24
Lobsters	172,671
Mackeral	-
Menhaden	18
Scup	14
Sea Bass	4
Sea Robins	36
Sharks	-
Skales	74
Sole	-
Squid	14
Weakfish	-
Whiting	3
Yellowtail Flounder	11
T O T A L	176,844

SOURCE: Draft Environmental Impact Statement. Trident Dredging Thames River Channel, Groton and New London, 1979.

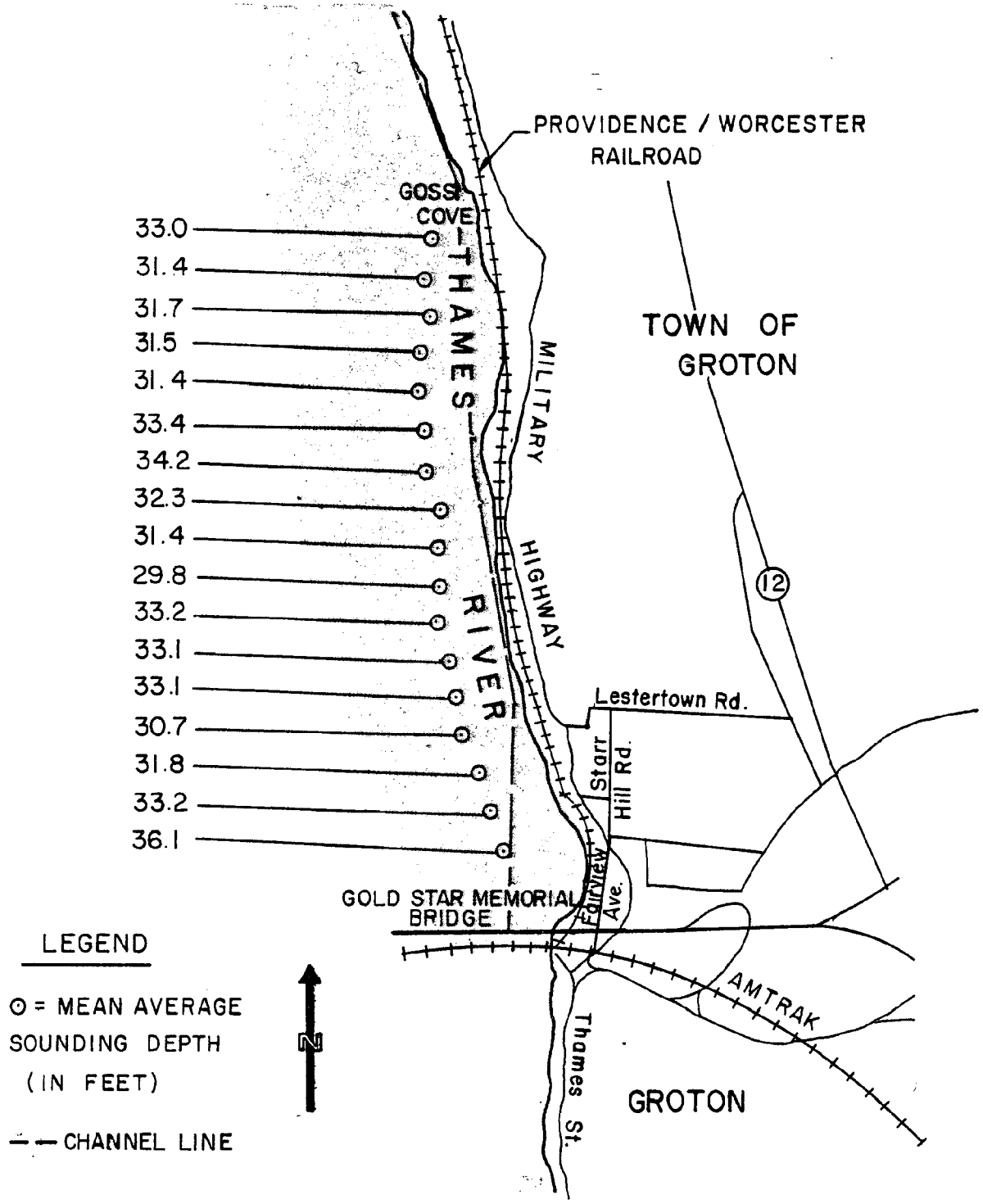
Marine algae are also abundant within the Thames River estuary (U.S. Coast Guard, February 1975). The dominant species in order of frequency of occurrence were Ulva lactuca (sea lettuce), Fucus sp., Chondrus crispus, Polyides rotundus and Gracilaria verrucasa.

Goss Cove has been characterized as a typical, slightly euphoric, tidal salt pond. Species noted included a filamentous green algae (Enteromorpha intestinilus), siluorsides (Menidia menidia), sheepshead minnows (Lyprinodon varlegatus), crabs and shrimp. An earlier study of the cove by the Navy in 1977 concluded that there was little or no evidence to indicate that Goss Cove is a productive breeding ground for any member of the Thames River Ecosystem with the possible exception of fundulus. Biologically, it was stated that the cove appeared to be generally low in the numbers of species and biomass of both plants and animals.

II.2.B Water - The Thames River is approximately 16 miles long, extending from Norwich to the Long Island Sound. The river is categorized as an estuary. An estuary is defined (Reid 1961) as a body of water in which the river water mixes with and measurably dilutes sea water. These conditions produce a system of two opposing current systems, the meeting of unidirectional stream currents and oscillating tidal currents which exert considerable and complicated effects upon sedimentation, water mixing, and other physical features of the estuary. The river's catchment area is approximately 1,400 square miles and includes parts of Connecticut, Massachusetts, and Rhode Island. The Thames River has an average flow rate of approximately 490 cubic feet/second at the New London station.

The water quality in the Thames River is presently classified as SC (suitable for fish, shellfish, wildlife habitat and good aesthetic value) from Greenville Dam in Norwich, to the shellfish closure line in Groton. (Connecticut Department of Environmental Protection, Water Compliance Unit, proposed water quality classifications for the Thames, Mystic, Niantic, Pawcatuck River Basin Maps, July 1981, Sheet 1). It has been proposed that the water quality goal of the river should be SB (suitable for bathing, other recreational purposes, industrial cooling and shellfish harvesting for human consumption and depuration, excellent fish and wildlife habitat and good aesthetic value). A 1974 survey conducted by the Connecticut Department of Environmental Protection (DEP) indicates that pollution occurs in the upper reaches of the river near Norwich. Fecal coliform levels are high with low dissolved oxygen in the upper reaches of the estuary. Also, downstream flushing of the estuary during ebb tides cause high BOD loadings. Water quality tests (Raytheon, 1975) suggest a decrease in water quality in the upstream direction. Norwich Harbor and portions of Shetucket have bottom dissolved oxygen concentrations approaching 6.0 mg/l, while surface concentrations are less than 3.1 mg/l. In summary, (Trident Dredging DEIS) the water quality in the estuary increases substantially as it flows toward Long Island Sound. Evidence of nutrient enrichment with high chlorophyll-a, low dissolved oxygen, and high coliform counts indicates a substantial pollution load applied to the upper reaches of the estuary.

The hydrographic conditions of the river were determined from a survey completed by the Army Corps of Engineers in 1975-76. Based on their recorded soundings, average depths were determined within a 600-foot band along the shoreline at 500-foot intervals. The average depth was 32 feet with approximate location of sounding averages indicated in Figure 9.



HYDROGRAPHIC SURVEY OF THE THAMES RIVER
SCALE 1"=2000'

SOURCE: US ARMY CORPS OF ENGINEERS 1976

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FIGURE 9

II.2.C Vegetation - The vegetation along the study area can be considered to be predominantly successional woodland. It has been determined that the vegetation is affected by the coastal influence of the river as well as the location of the railroad and Military Highway. Continued disturbance from these factors limit the extent and diversity of the plant communities found along the coast of the Thames River. Common tree species include, oak, red maple, and black cherry. Common plants include goldenrod, sedges, Queen Anne's lace, bayberry, poison ivy, viburnum, and a variety of grasses and low herbaceous bushes. The existing vegetation provides a good buffer from coastal erosion and supports active populations of song birds and other migrant bird species.

II.2.D Soils - The predominant soil type within the shorefront study area is Canton-Charlton fine sandy loam (15-35 percent slopes)on glacial till upland hills, plains, and ridges. This soil type is considered to have a high erosion potential because it has limitations related to slope and stoniness. The permeability of this soil is rapid in the surface layer and subsoil and very rapid in the substratum. The available water capacity is low and the soil is extremely acidic. The abundance of ledge is evident through field inspection and is a limiting factor for development.

II.2.E Coastal - The study area is classified by the State of Connecticut as shoreland for its entire length with the exception of the area near the U.S. Naval Submarine Base which is designated as developed shorefront (D) (see Figure 5).

The coastal hazard areas include those lands innundated during coastal storms or subject to erosion as a result of the storms, including flood hazard areas as defined in the National

Flood Insurance Program. Coastal hazard areas along the Thames River are identified as V-9 and V-10 zones with base flood elevations including velocity wave action. The flood elevations at the southern portion of the site are 11 feet above sea level and 13 feet for the northern portion. These flood zones are constraints to development and active uses must be carefully assessed before allowed in this area.

The Thames River is classified as an estuarine embayment, as is the small inlet near Military Highway and Crystal Lake Road. The Town's municipal coastal program (MCP) 1982, reports that estuarine embayments are defined as "protected coastal bodies of water with an open connection to the sea in which saline sea water is measurably diluted by fresh water including tidal rivers, bays, lagoons, and coves." These embayments are usually characterized by high turbidity and fine sediments, and may contain submerged flats of eelgrass (Zostera marina). Due to their small water volume, fine-textured sediments, and restricted circulation, estuarine are especially susceptible to pollution.

The north western portion of the town's coastal zone, which borders the Thames River and includes the Submarine Base, contains one tidal wetland located on the northern edge of Goss Cove. According to the U.S.S. Nautilus Environmental Assessment report, this wetland is of minimal value. The report also states that Goss Cove is an estuarine embayment, but of questionable value. Proceeding south, the next portion of the town encompassed by the coastal boundary is the airport area, which is rimmed with tidal wetlands. Plain Creek and Baker Cove, which form the boundary between the city and town of Groton, are both lined with a narrow band of tidal wetlands. The town's MCP also states that the developed western portion of the town along the Thames River contains one freshwater wetland watercourse located just south of Grove Avenue which flows into the Thames River. Proceeding south, there are some freshwater wetlands near Plain Creek and High Rock Road.

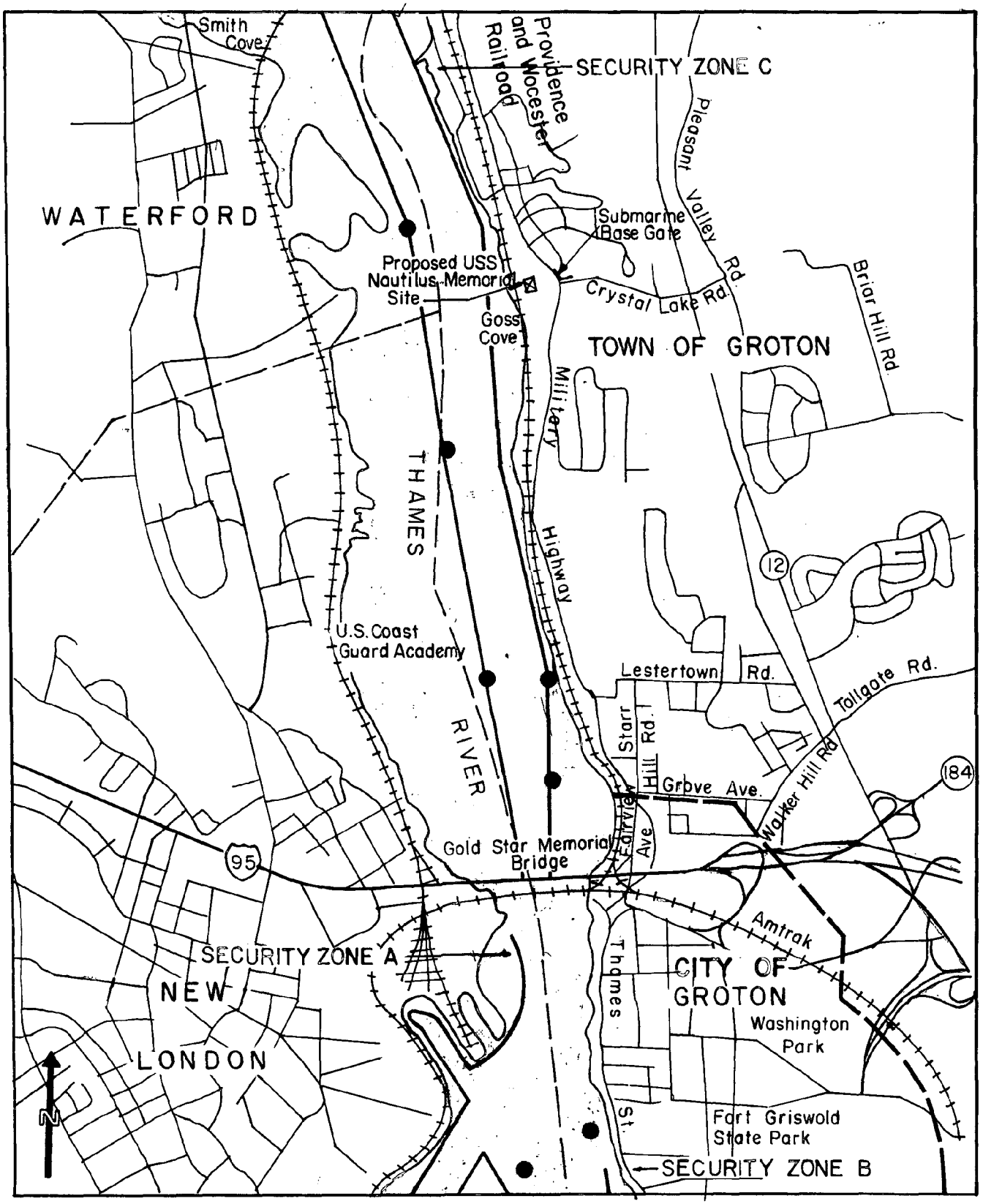
II.3 Transportation System

The study area is close to major elements of the regional highway network and is served directly by Military Highway running along its east boundary. The Providence and Worcester Railroad is an active freight-carrying and occasional passenger service line running through the area, parallel to and between the Thames River and Military Highway.

Significant features of existing facilities and services as well as proposed changes and additions are summarized in this section. These include:

- The highway system, including identification of critical intersection locations, and the availability of public parking;
- Water transportation, including marine facilities and potential ferry and river cruise services;
- Public transportation services - existing and potential;
- Bikeways - existing and proposed.

The major transportation facilities are identified in Figure 10.



TRANSPORTATION FACILITIES

SCALE 1" = 2000'

Wilbur Smith and Associates

FIGURE 10

II.3.A Highways - Military Highway runs south from Crystal Lake Road to Fairview Avenue which links Military Highway with Thames Street in the City of Groton. The existing Military Highway has a paved surface of approximately 25 feet throughout most of its length. There are no substantial shoulders and relatively few driveways or other entrances to property along this route. Improvement of Military Highway has long been an objective of the Town and the Regional Planning Agency. Although traffic is light during most hours, it does serve as a convenient alternative route to and from the Submarine Base, and for employees commuting to and from the City of Groton.

An examination of preliminary improvement plans for Military Highway shows little change proposed in horizontal alignment but significant changes in vertical alignment, with pavement level raised or lowered in many areas. The changes in grade, coupled with the widening of the route, will result in many new cut and/or fill sections.

There are a number of other routes which have a direct relationship to site area access as they are the connecting links to the regional network.

Route 12 - Connecticut Route 12, a 4-5 lane facility, 47 to 60 feet in width, is one of three highways linking the New London area and Norwich, and the only such route east of the Thames River. (I-395, the Connecticut Turnpike, experienced the

most traffic growth in the past decade, while Routes 12 and 32 have not.) Route 12 is noteworthy as the principal access route to the Submarine Base for traffic approaching from the west on I-95, from the east on Connecticut I-84 and I-95, and from points in Groton. Average daily traffic on Route 12 north of Crystal Lake Road was estimated to be 13,000 in 1980. South of Crystal Lake Road the ADT was 20,700, the difference being attributable to Submarine Base traffic using Crystal Lake Road. Peak flows occur during the hours of 6:45 to 8:00 A.M. and 3:45 to 5:00 P.M. Traffic data obtained from the U.S. Navy also shows that increased traffic is present at 6:45 P.M.

Crystal Lake Road - The access route from Route 12 to the Submarine Base gate is Crystal Lake Road. At its north end, Military Highway intersects Crystal Lake Road near the gate area. The intersection of Route 12 and Crystal Lake Road is a major signalized intersection. The intersection of Military Highway and Crystal Lake Road at the Submarine Base gate is not signalized. However, that location is also the point of access for the proposed USS Nautilus Memorial, and as such, it is expected that consideration will be given to the future signage/signalization of the intersection.

Fairview Avenue - Fairview Avenue serves as a direct extension of Military Highway south into Thames Street in the City of Groton. Important intersections are:

- The intersection of Military Highway/Fairview Avenue with Grove Avenue. This is located immediately south of the junction of Military Highway and Starr Hill Road; and,

- The intersection of Fairview Avenue and Bridge Street near the north end of Thames Street.

Access to the state boat ramp is from Fairview Avenue. Fairview Avenue crosses over the Providence and Worcester Railroad and under the Amtrak Shoreline route.

II.3.B Parking - Little, if any, public parking is available at present in or near the study area. A private lot near the Submarine Base gate at the north end of Military Highway serves base employees. Virtually no parking is possible off the traveled way of Military Highway. The proposed shoulders on the reconstructed Military Highway would be designed for emergency use only. Parking facilities proposed for the USS Nautilus Memorial appear to be limited, and, in any case, not designed to provide parking for visitors while off-site. A proposed overlook area adjacent to the Nautilus site would also provide limited parking. The state boat ramp area on Fairview Avenue does not provide any more than a limited amount of parking for ramp users.

If the City of Groton implements the plans in their Thames Street study additional parking spaces would be provided from the proposed central parking facility. Use of this facility would require availability of a bus or tram system, possibly in conjunction with a shoreline ferry service. This is discussed further in Section II.4.C.

II.3.C. Water Transportation and Marina Use - There are at present no local water transportation services originating from the Thames River in Groton. In New London there are terminal services for ferry operations to Fishers Island, Orient Point, on Long Island, and in summer to Block Island. The State Pier at New London was completed in 1915 and has been in continuous use ever since. The Pier is owned and operated by the Connecticut Department of Transportation through its Bureau of Waterways. The 200,000 square foot pier extends 1,000 feet into the river and contains a two-story storage shed adapted for use in handling cargo. An adjacent pier, owned by the Central Vermont Railroad, is currently being used to unload copper destined for the Phelps Dodge Copper Products Company in Norwich. The north side of the State Pier is currently under long-term lease to the U.S. Navy. The lease runs until the year 2013. The Navy uses the State Pier location for submarine repair and maintenance. Plans are now underway by the Navy to undertake a major construction project at State Pier that would include dredging and installation of a 500-foot long steel bulkhead for docking small boats and support vessels. The southerly side of the Pier is used for commercial port operations. This side has access to a total of 280,000 square feet of covered storage areas and approximately 15 acres of yard area. In the summer, sightseeing services are offered by boat from a Thames Street location in the City of Groton. The recommended plan in the Thames Street study incorporates a shoreline water transport system. However, it is reasonable to assume that such services would be highly dependent on shoreline attractions and facilities, including but not limited to, the USS Nautilus Memorial and convenient central parking availability.

Pleasure boating in Connecticut has grown to become a large industry which supports many commercial establishments along the coast. A study completed by Raymond Farrish, "The Connecticut Shore-Based Marine Industry" concluded that the marina industry in Connecticut is characterized by owner-operated and closely controlled businesses. Approximately 90 percent of the firms are owner-operated, and are organized as individual proprietorships, partnerships, or corporations with 10 or fewer stockholders. About 60 percent of the firms responding to the marina study questionnaire classify themselves as marinas, a third classify themselves as boatyards, and the remainder as yacht clubs, or other designations. Table 2 enumerates marinas, moorings, and slips located in or near Groton which give an indication of the present usage and future demand.

It has also been reported (Marine Advisory Service, The Connecticut Charter Boat Fleet: Its Characteristics, Costs, and Returns) that one vessel uses Groton as its homeport. However, several vessels port in New London to provide additional service. Commercial sport-fishing is a growing sport which takes advantage of the sound and its diverse aquatic resources.

II.3.D Public Transportation - Regional bus service is provided by Southeast Area Transit (SEAT). The system provides local transit north to Norwich, west to East Lyme, and east to Stonington. Frequency of daily service on Route 12 to the Submarine Base area is two hours.

Railroad passenger service is provided by AMTRAK on its shoreline route. The service is oriented to interregional users. Area stations are in Mystic (limited stops) and in New London. Commuter service in the Providence-New Haven section ended in 1978. Limited passenger service between Norwich and Worcester is presently being provided on an experimental basis.

Table 2

CONNECTICUT MARINA INVENTORY (1975)

TOWN	MARINAS/ YACHT CLUBS	MOORINGS	SLIPS	COST PER FOOT	NEED TO EXPAND
New London	7	139	432	$ 11.50	3
Norwich	1	0	65	N/A	1
Ledyard	2	6	84	N/A	1
Groton	19	472	1150	13.00	18
State Total	251	4565	20527	13.50	148

SOURCE: Westgate Associates, Market Study and Recommendations, Marina Site, Waterfront, and Downtown Norwich, Connecticut, 1980.

Although studies have been made of the feasibility of rail passenger service on the Thames River P&W route, there is little likelihood of such services being implemented. The operating cost advantage and the service flexibility of bus services tend to favor that mode.

II.3.E Rail Freight Service - The P&W operates freight only service on its New London-Norwich-Plainfield-Putnam-Worcester routes. This service results in two to three trains daily, each consisting of approximately 15 cars. Operating speed is about 35 mph. P&W also operates freight service on the AMTRAK owned shoreline route. The railroad has been promoting excursion trips for foliage viewing, corporate meetings, and other special activity functions. As this activity becomes more popular more accommodations will be made by the Providence and Worcester Railroad.

II.3.F Bikeways - The Town of Groton developed a bikeway proposal in 1975 that presented a three phase plan for bikeway development. That plan included a Military Highway segment. Such a bikeway link would tie into other proposed bikeway sections in Groton.

II.4 Administrative/Regulatory Controls

The study area is regulated by a combination of Federal, State, and local laws. These laws protect the shoreline from undesirable development which could adversely effect the environment, public health, safety and welfare of the residents of Groton. It is important to note that the majority of the study area is owned by the Providence and Worcester Railroad and their rights as a private landowner need to be considered and respected in all future planning purposes.

In addition to the railroad ownership of the majority of the land area, there are two private residential properties which along with the U.S. Navy Base, constitute the landowners in the study area. Presently, the Navy is discussing with one of the property owners the feasibility of purchasing the parcel as part of the museum plans proposed for the Goss Cove area. The following discussion summarizes the controls which regulate the use of the study area.

II.4.A State of Connecticut Coastal Area Management Program - The Connecticut Coastal Management Act (CCMA) of 1978 Connecticut (C.G.S. 22a-90-113) established a comprehensive coastal resource program designed to manage and protect the coastal resources in the state. The act provides a management framework through the joint coordination of municipal and state authorities. The significance of the legislation is the delineation of the coastal management boundary, the establishment of specific coastal policies, standards, and procedures to direct the implementation of the program and the definition of management responsibilities for agencies at both the state and local levels of government.

The Municipal Coastal Program is one of two major components of a comprehensive coastal management system at the local level. Together, the Municipal Coastal Program and the Coastal Site Plan Review give municipalities the authority to consider and base land use regulatory decisions on the anticipated impacts of proposed activities on coastal resources. In contrast with and in support of this project-by-project management component, the Municipal Coastal Program provides municipalities with an opportunity to undertake coordinated long range planning and management of their coastal resources. Thus, the Municipal Coastal Program gives overall direction and guidance for the case-by-case Site Plan Reviews.

The Coastal Site Plan review and approval process is augmented by an application which requires the applicant to detail specific information which allows the Town to evaluate the potential impact of the proposal on coastal resources. Specific required information includes the following:

- o Description of the proposed project;

- o Identification and description of Coastal Resources (as defined in Section 3(7) C.G.S.-22a-93) at and adjacent to the Site; Description of the character and condition of all coastal resources;

- o Identification and description of significant natural features occurring at and adjacent to the site;

  - Identification and description of types, extent and condition of plant and animal species; type and extent of ground cover, and soil types and any limitations of predominate soils.

    a. dominant species of flora (marine, wetland, upland); occurrence of any rare or endangered species.
    b. dominant species of fauna (marine, wetland, upland); occurrence of any rare or endangered species.

  - Assessment of value and quality of plant and animal habitat.

  - Identification and description of type, extent, and condition of significant geologic and hydrologic features (such as aquifer recharge areas, deposits of sand and gravel, unique geologic features, etc.).

- o Identification and Description of significant historical and cultural features occurring at and adjacent to the site (e.g. historical, archaeological, scenic, recreational, etc.);

- o Identification of applicable coastal policies (as established or as referenced in Section 2 of C.G.S. 22a-93;

  - Identification of applicable coastal resource policies (from C.G.S.22a-92 Section 2(b)(2)).

  - Identification of applicable coastal use policies (from C.G.S.22a-9 Section 2(b)(1)).

- o Explanation demonstrating how the proposed project is consistent with the applicable coastal policies identified above;

- o Identification and description of potential adverse impacts (as defined in Section 3(15) of C.G.S. 22a-93) and potential beneficial impacts of the project on Coastal Resources (as defined in Section 3(7) of C.G.S. 22a-93.

  - Identification and assessment of the beneficial and adverse impacts of the proposed activities on the condition, character, function and value of the coastal resources affected by the project (both on-site and off-site) including impacts on natural and cultural features of the site and impacts on water quality, air quality, flooding and erosion.

  - Assessment of the nature and magnitude of all impacts identified above (quantified where possible).

- Assessment of the permanence of the resource commitment (e.g. short-term/long-term, irreversible or irretrievable).

o Description of the proposed measures to mitigate the adverse impacts identified above on coastal resources (e.g. measures to control or prevent erosion, sedimentation and runoff, measures to prevent deterioration of coastal resource quality, measures to prevent violation of air and water quality standards, etc.);

o Identification and description of potential beneficial and adverse impacts on opportunities for future water dependent uses (as defined in Section 3(16) of C.G.S. 22a-93) on and adjacent to the site;

o Description of proposed measures to mitigate adverse impacts on opportunities for future water dependent use of the site or the surrounding area (e.g. measures to provide for future water dependent use of the site or the surrounding area); and,

o Description of any adverse impacts that remain after employing all reasonable mitigation measures and explanation demonstrating why these remaining impacts are acceptable.

The primary state agency involved in the program is the Department of Environmental Protection (DEP) which receives and administers coastal zone management funds, and is also responsible for monitoring, evaluating, and coordinating the overall implementation of the program.

The policies in the CCMA together with policies taken from other existing statutes make up the Connecticut Coastal Management Program. The CCMA provides a framework by which coastal resource management considerations can be incorporated into the decision making process.

The legal authority for the Program was designed to accomplish four primary tasks:

1. To insure that all uses of the coast minimize impacts on coastal resources and are subject to management control. Also, to resolve between alternative uses of the shoreline.

2. To coordinate the coastal management activities of the various state and local agencies implementing the program.

3. To integrate coastal management considerations with other land and water use concerns by incorporating them under existing programs.

4. To implement the Program's resource management/ impact zoning approach for controlling coastal uses.

II.4.B Town of Groton Plan of Development/Municipal Coastal Program - A Coastal Program was developed for the Town of Groton in 1982 to address issues and problems within their coastal jurisdiction. The Groton MCP has provided specific coastal policies which help to frame the intentions of the coastal program. Because of the complexity of the Thames River study area it is prudent to review some of the policies as follows:

COASTAL WATERS

1. Encourage the maintenance of existing navigation channels along the coves and rivers to ensure access remains open by developing a plan for a mooring system, and land-related marina complexes, in heavy boating areas such as the Mystic River;

2. Upgrade the coves, rivers and bays along the coast so that they can be better used for recreation and fishing, including protection against wastewater discharge and spills associated with public sewer systems.

3. Develop a timetable with the state to reopen marginal shellfish beds.

4. Encourage the development of an overall policy and plan for control of dredging and filling in coastal waters.

OPEN SPACE AND RECREATION

1. Preserve the open character of the Mystic River by limiting development in certain areas.

2. Increase public access to waterfront areas including recreational boating and fishing access to the shore and navigable waterways. Public and private development projects should be considered in relation to this concept and encouraged to promote it.

3. Improve public use of the waterfront by actively pursuing new facilities and expanding existing facilities for recreation, specifically beaches, encouraging public access to the waterfront in built-up areas, and requiring clean-up of derelict structures and debris from the water's edge.

4. Encourage the creation of walkways and bikepaths along the shoreline.

5. Preserve sensitive coastal resources such as tidal marshes, beaches, dunes, bluffs, and the river's edge.

6. Encourage the development and maintenance, of the U.S.S. Nautilus as a major high quality tourist attraction while minimizing adverse impacts to the coastal area.

TRANSPORTATION

1. Encourage the improvement of public transportation in the coastal zone by bus, train, and ferry service.

COMMERCIAL AND INDUSTRIAL

1. Prevent the degradation of water quality where new industrial development takes place within the coastal zone. Review potential discharge and containment of industrial waste and drainage through the coastal site plan review process, to ensure compliance with applicable federal and state environmental health and safety standards.

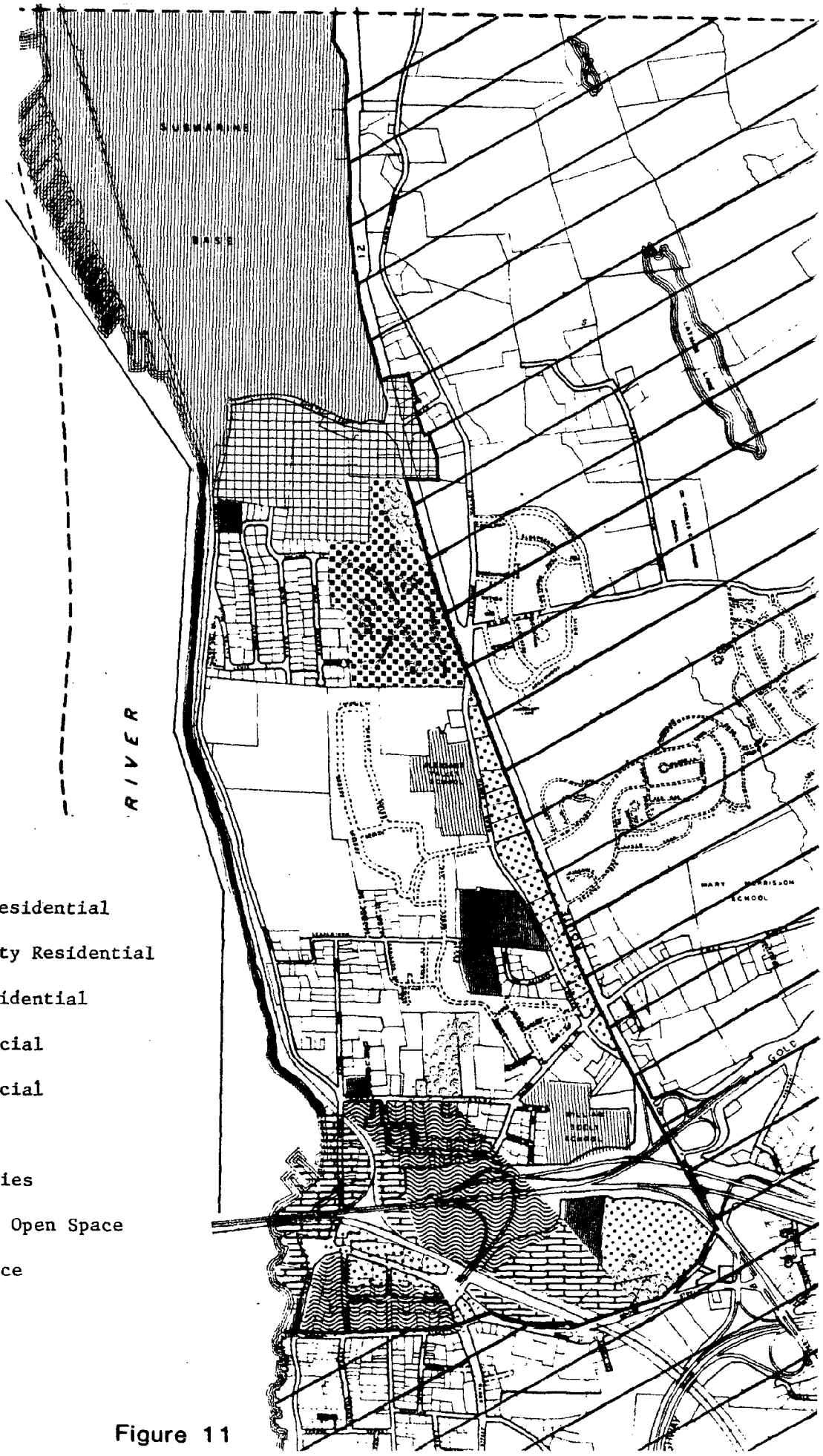
2. Give high priority and preference to water-dependent industrial and commercial uses and facilities in existing developed and non-sensitive shorefront areas.

The MCP also provided the opportunity to propose policies and recommendations to manage and enhance their coastal area. The study area was addressed in the plan since it encompasses a significant portion of the Town's shoreline and also is situated amidst active uses (U.S. Naval Submarine Base), and is in line for a major tourist attraction (The USS Nautilus Memorial and Submarine Force Museum). The plan notes that there will be an influx of tourists after the development of the Nautilus Museum. A revision to the Town's Plan of Development has been made to designate the land adjacent to the Nautilus site as tourist commercial to accommodate and control the potential development and spinoffs from the tourist attraction. Also, the Nautilus is expected to generate new commercial development outside the coastal boundary, along Route 12, and that the Plan of Develop-

ment designation of tourist commercial should be considered for extension to this area. The Plan of Development (see Figure 11) illustrates that the study area is designated as recreation and open space. The Submarine Base immediately north of the site is classified as public facilities while low and rural density residential properties exist to the east of the study area. The goal is to develop a high quality service area rather than allow scattered development of various types which would adversely affect the integrity and distinction of the coast.

The Groton Coastal Plan recognizes that the Nautilus Museum would provide significant benefits to the community and region and the following conclusions are contained in the Town's Economic Development Policy Statement (EDPS):

- Tourism is recognized as an important part of Groton's economic base, augmenting existing commercial activity;
- Suggestion by the coastal task force which echoes the EDPS report is the promotion of the USS Nautilus as a major tourist attraction. The coastal task force has suggested the establishment of a ferry service between the memorial and New London;
- Support the establishment of a National Maritime Historic Park along the Thames River;
- The Town should examine the feasibility of intensifying the use and development of water related development along the Thames and Mystic Rivers and the Sound in keeping with the CAM guidelines.



EXISTING PLAN OF DEVELOPMENT 1984

LEGEND

- High Density Residential
- Moderate Density Residential
- Town House Residential
- General Commercial
- Tourist Commercial
- Industrial
- Public Facilities
- Recreation and Open Space
- Natural Resource

Figure 11

These are ambitious town goals which are dependent on the Nautilus opening, implementation of municipal controls (zoning), and acceptance of new land use plans. The Coastal Plan recognizes that the study area may not be optimum for all types of development. MCP policies and recommendations which apply to the site are:

1. The waterfront along the Thames River may provide for future water oriented facilities in existing developed and nonsensitive shorefront areas;

2. The need for more public boat launching areas;

3. Parking may be limited if the museum facility is developed and access by water and by rail should be promoted; and,

4. Enhancement of the visual and aesthetic values should not be overlooked.

The Coastal Program for Groton provides a guide for the Town to encourage the right types of development activities and to preserve amenities which provide the existing dignity and identity of the shoreline.

II.4.C City of Groton Municipal Coastal Program - The City of Groton prepared their own Coastal Program in 1982; the City's coastal zone was divided into northern and southern sections. The plan identifies that in the northern section the major issues are the preservation of Thames Street as an historic area, limited access to the Thames River, and increased tourist traffic and parking anticipated from the opening of the Nautilus Museum. It

is prudent to discuss the City's plan as it affects this study. Even though the shoreline is divided by political boundaries, it functions as a complete entity for natural systems as well as for transportation and other infrastructure requirements. Specific coastal issues which apply to the study area include:

1. The establishment of the Nautilus Museum as a tourist attraction is expected to result in an increased amount of traffic during the summer. Tourists proceeding to the City from the Memorial are likely to travel along Military Highway, or Route 12, both of which are over-utilized;

2. The establishment of major new parking areas for tourists is not a water-dependent use and is not encouraged in the coastal zone. Visitors should be brought to the area by shuttle bus from parking areas outside the coastal boundary; and,

3. A strategy to limit traffic in the coastal zone is to discourage the establishment of new truck routes through residential routes within the coastal zone. Specific recommendations were made in the plan to minimize coastal impacts and to accommodate future growth. The City should encourage:

   - o development of new parking areas outside the coastal zone;

   - o encourage the revitalization of the historic district along Thames Street;

- encourage the establishment of a regional committee (City of Groton, Town of Groton and City of New London) to discuss and plan for anticipated tourist and parking related problems;

- support the reconstruction of Military Highway in the Town of Groton to accommodate the anticipated increase in vehicles to the area; and,

- encourage the development of deepwater docking facilities and commercial fishing goals on the river in the vicinity of the Gold Star Bridge, and encourage industry to utilize docking facilities to accommodate deeper draft vessels.

II.4.D Town of Groton Zoning - The study area is adjoined by land zoned as residential (R-12), with a small band of commercial retail, and multiple family (RMF). It can be expected that with the construction of the Nautilus Museum, increased pressures will be placed on residential properties to convert to more active uses. At present, draft revisions to the regulations are being considered by the Zoning Commission which would rezone areas that are in prime locations for tourist related development adjoining the Nautilus site. This type of planning is necessary to prevent ad-hoc development from occurring and causing a deterioration of the residential neighborhoods near Military Highway. The zoning authority of the Town can be considered as a key regulating control to preserve and develop parcels of land in an appropriate manner.

II.4.E Bureau of Waterways, Connecticut Department of Transportation - The Bureau of Waterways regulates all navigable waters in the State of Connecticut. One of their functions is to review all applicable construction and use permits submitted within navigable waters to the Department of Environmental Protection. An inspector from the Bureau reviews the applications and may comment to the Department of Environmental Protection on a case by case basis.

II.4.F Army Corps of Engineers, Department of Defense - There are two areas of potential participation by the Army Corps for the Thames River project. First, the Army Corps has jurisdiction over the federally designated channel in the Thames River. Any dredging or construction of structures such as docks and piers within the river must be reviewed and permitted by the Corps. Secondly, any activity which places fill in the coastal zone or navigable waters will be required to comply with the regulations set forth in the Rivers and Harbors Appropriate Act of 1899 (33 U.S.C. 401 et seq.), and Section 404 of the Federal Water Pollution Control Act Amendments of 1972 (33 U.S.C. 1344). The 404 permit program is administered through the Secretary of the Army, acting through the Chief of Engineers, to regulate the discharge of dredged material into the waters of the United States and of those pollutants that comprise fill material. Applications for Section 404 permits are evaluated by using guidelines developed by the Administrator of EPA in conjunction with the Secretary of the Army. The Chief of Engineers can make a decision to issue a permit that is inconsistent with those guidelines if the interests of navigation require. It is also required that all of these permits are consistent with the State Coastal Management Act.
Act.

The U.S. Coast Guard and the U.S. Navy have established Security Zones along the Thames River (see Figure 10). These zones are regulated by the Captain of the Port of New London (U.S. Coast Guard). Private, commercial and military mooring, docking, or construction in these areas either on the shoreline or in the river is restricted and can only be used under special permission from the Captain of the Port.

II.4.G Department of Environmental Protection Water Resources - The Department of Environmental Protection has permitting authority within and affecting coastal, navigable and tidal waters. Jurisdiction is provided through state statute, CAM legislation, and Federal laws.

II.5 Tourism and Market Trends

There have been many recent studies which have found that tourism has become a major industry in the Northeast. A major reason for this phenomenon is the attraction that people have for the ocean. It has been seen in many Connecticut and Rhode Island communities that there have been increasing demands to utilize the coast for recreational, residential, and tourist related uses. The concept of a "tourist" has also changed in recent years. The post-gasoline crisis years has made people more cognizant of the cost of travel and has enlightened many to the local and regional opportunities which previously were taken for granted. The tourist is now no longer the midwesterner coming to the east, but is in many cases an in-state resident who has found that a good vacation can be achieved without travelling many miles away.

In a 1978 survey by Mystic Seaport, it was noted that most of Mystic's visitors live in the Northeast (78 percent) which includes New England, New York, New Jersey, and Pennsylvania. Connecticut residents represent 18 percent of the yearly visits to Mystic. Fifty-seven percent of the visitors are from Connecticut and bordering states. Visitors consider themselves local if they live in Connecticut, New Jersey, Long Island, or metropolitan New York (45.8 percent). Sixty-six percent of the members of the Seaport are local, as compared to 45 percent of the nonmembers.

The USS Nautilus Memorial and Submarine Force Museum is projected to be a major tourist attraction. The Environmental Assessment for the facility reports that 170,000 - 230,000 persons are projected to visit the facility annually, many in conjunction with visiting the area's other tourist attractions. The assessment states that "this will have a significant positive impact on the regional tourism economy and contribute to development of a year-round tourist industry in the region." In addition, as part of An Action Plan for the Development of the Thames River Area, a recommendation was made that an areawide organization (S.E. Tourism District) for the Thames River be created and that direct promotion of tourism be one of its tasks.

There are four significant attractions in the Groton area which provide a variety of amenities for visitors. They are:

		1981 Number of Visitors
1.	Marine Life Aquarium, Mystic	- 636,000 visitors
2.	Ocean Beach Park, New London	- 496,000 visitors
3.	Rocky Neck State Park, East Lyme	- 478,000 visitors
4.	Mystic Seaport, Mystic	420,000 visitors

The question arises regarding the potential use of the Thames River for local and tourist needs. The attraction of tourists and residents to the shoreline has been prompted by the special events which have complemented the more traditional areas of recreation which have prospered for many years. Popular activities include:

- The fireworks over the Thames River, cosponsored by the Town of Groton and the City of New London;
- The Yale/Harvard Regatta;
- Raft Races;
- The viewing and tours of the Eagle at the Coast Guard Academy;
- The launching of the submarines at Electric Boat; and,
- The reenactment of the Battle of Fort Griswold.

The Town's MCP has identified the problems of congestion and over development in the Mystic River area. Also, the plan has emphasized regulations limiting dock, mooring and dredged fill development in the area. The rapid growth and congestion, and concern for regulating in the area growth, show that local demand for water dependent uses in the area is high.

A market study for marina site development in Norwich (1980) states that Spicer's Marina located on Shennacosset Road in the City of Groton, along the Thames River, has a waiting list every year for docking and mooring space. The report also states the recreational boating along the Thames River averages 200

boats per day. Groton is reported to have a ratio of one boat per 24 residents, 50 percent higher than the state average of 48 persons per boat.

The addition of docks and moorings along the Thames River would relieve some congestion in the Mystic River area. Using competitive prices and adequate facilities and access, marina development in the area would be beneficial and profitable.

The residential area above the Thames River, known as Bailey Hill, lacks recreational facilities so residents must go elsewhere. Development along the Thames River would provide recreational benefits for the area as well as an aesthetic appearance and atmosphere.

Many residents of Groton use the study area for fishing. During the summer, several fishermen can be seen each day along the banks of the Thames. At present, the number of users is small compared to other areas, but with improved access and facilities, this activity would increase.

The boat launch ramp below the Gold Star Bridge is utilized by a number of local residents. These users are primarily pleasure or sport boaters who spend the day boating. However, the use of the facility is restricted by its size and on-site parking conditions. Here again, improvement on-site or the development of an additional site should increase usage of the boat launches along the Thames River.

Chapter III
DESCRIPTION OF ALTERNATIVE USE SCHEMES

This chapter will describe the development of alternative use schemes with special emphasis placed upon constraint to development and alternative means of access.

Numerous use schemes were evaluated but were deemed unfeasible because of severe topographic constraints as well as access limitations. The influence of the coastal environment also created a significant constraint because of the proximity to open water and the necessity to develop a plan which is compatible and not in conflict with coastal policies for the area.

III.1 Constraints to Development

In most cases, optimum locations for recreational uses are situated in areas which may have good access by automobile and by pedestrians. The ease by which people can gain access to the attraction ultimately dictates the degree of success or failure for the enterprise. There are limitations for attaining access to the shorefront along the Thames River, thereby requiring us to look at innovative ways to create an interface between the study area and Military Highway and Fairview Avenue. This can be considered as a physical constraint for a functional use of the shoreline. Physical constraints evident for utilizing the study area are:

- Lack of available access for vehicles and pedestrians;
- Predominance of steep terrain;

- Inadequate roadway systems adjacent to the site;
- Conflict of the close proximity to the railroad; and,
- The lack of utilities is always considered as a development constraint.

Mapping supplied by the Town of Groton indicates that a water main of unspecified size lies beneath Military Highway. The main extends from the Fairview Avenue, Military Highway intersection to the Military Highway Crystal Lake Road intersection. It also indicates that few residences are supplied by the water main which is the major water source for the Submarine Base. A sewer pipe, also of unknown size, is located beneath Military Highway. This sewer main services the residences above Military Highway at Bailey Hill Road and Fulton Drive. From the Fulton Drive, Military Highway intersection, the main proceeds approximately 2200 feet northward to Crystal Lake Road. At this point the effluent is pumped up Crystal Lake Road and finally to the treatment plant.

A most important constraint to consider is the ecological value of the area with respect to coastal resources of the Thames River. The Town Municipal Coastal Program previously described in Chapter II was developed to make sure that the development and use of such areas would be compatible with the environment. This means that proposed uses should not create adverse conditions which may degrade the river or other related resources. Alternative use schemes have been assessed with this constraint in mind to assure that they would be consistent with state and local resource protection statutes. Ecological constraints are those areas which have a high natural value which can become limiting factors for development.

The prominent ecological constraints which are noteworthy for this area are as follows:

- o Severe slopes prohibiting development opportunities. Erosion potentials would increase with major modifications;
- o Dredge and fill operations in the river could increase turbidity during critical spawning periods for finfish;
- o The undisturbed vegetation of the shoreline provides a buffering affect for the coast;
- o The scenic view of the site from the Thames River and Military Highway could be endangered with active use schemes;
- o Existing vegetation provides limited but valuable wildlife habitat for small mammals and songbirds;
- o Potential increase in runoff into the Thames River; and,
- o Development of undeveloped coastal resources.

The Town has passed a floodplain management ordinance as part of the zoning regulations and thus influences potential development along the Thames River. All construction in the coastal flood hazard area would be subject to these regulations. Regulations pertinent to the Thames River include:

- All new construction shall be located landward of the reach of mean high tide;
- All new construction or substantial improvements shall be elevated on adequately anchored pilings

or columns so that the lowest floor is elevated to or above the base flood level; and,

- No fill shall be used as structural support for buildings.

These regulations would control the method and types of commercial development along the study area unless special provisions are granted. The base flood elevation as stated in the MCP is 11 feet above mean sea level. Therefore, the majority of the existing land between the railroad and the shoreline would be subject to these regulations. The Providence and Worcester Railroad track is a prominent feature of the study area coastline. During the course of the study, discussion was initiated with the Providence and Worcester Railroad, and it was determined that the most serious concern to the railroad is the potential safety problem which would result from attracting persons to the track area. From past experience, it has been found that there is a liability problem for the railroad when active uses are located near their facility. Inevitably, people do not obey signs or warnings and will cross or walk along the railroad tracks. This study presents a variety of options which are both isolated from the track area and those which are adjacent. If specific elements of any of the use schemes are implemented, design features will be needed to prevent people from gaining access to the railroad tracks. However, it should be noted that many people now use the shoreline for fishing and relaxation.

Several development schemes were examined which utilized extensive water dependent commercial activities. These activities included:

- o Extensive marina development;
- o Coal transfer facility;
- o Fish processing plant; and,
- o Oil refinery or transfer facility.

These use scenarios require docking facilities, large tracks of developable land, and efficient access to and from the shoreline. The problem of limited existing land area could be solved by means of dredged fill containment areas while vehicular access could be improved by bridging the railroad tracks, thus connecting Military Highway with the shoreline. However, numerous problems would restrict this type of development. The proximity of the development to the existing channel (100 to 1,000 feet from shore) would restrict the size of potential docing facilities as well as the extent and method of dredged fill containment. The existing river bottom conditions would hinder the development of dredged fill containment areas and the cost of the base line development (bridge, docks, and dredged fill containment area) would approach or exceed $30 million. The environmental and aesthetic impacts associated with such development could be extensive and costly to mitigate during construction and control during operation. Limited water dependent commercial and recreational uses such as fishing piers and small pleasure boat docking facilities would be better suited for the area and are discussed in Scheme III.

III.2 Alternative Means of Access

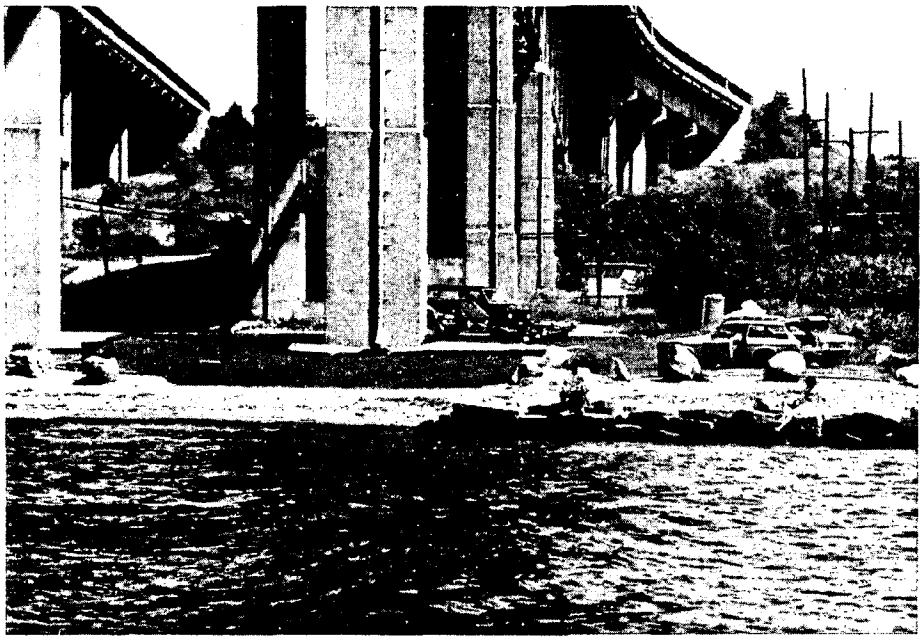
Based upon the available mapping and data provided during the course of the study, alternative means of access were developed as potential solutions to the existing conditions. It was realized that a critical condition exists and that significant improvements are needed in order to enhance the viability of the study area.

III.2.A Vehicular Access - Access to the study area by means of motor vehicle is a primary concern. Accompanying each development scheme are several areas which can accommodate vehicular access for pulloffs to provide areas for picnicking and viewing of the Thames River. These scenic overlooks provide direct access to select areas and are essential elements in the positive development of the study area. However, topographic constraints restrict the size of the overlooks and consequently, the amount of parking spaces are limited.

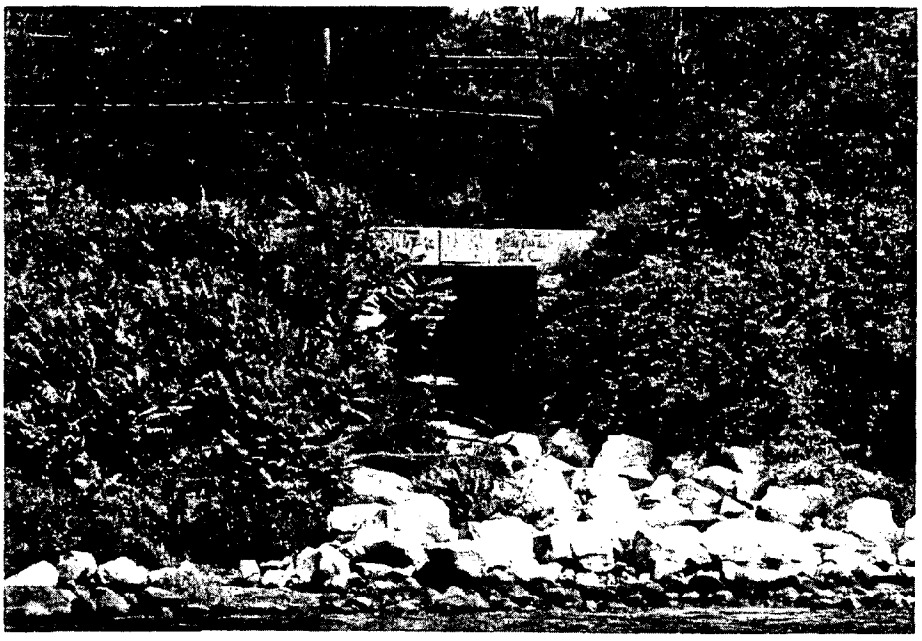
To compensate for limited parking at the overlook sites, access is provided by two areas south of Whaling City Dredge and Dock Corporation. These sites include the existing boat ramp under the Gold Star Bridge (see Figure 12) which may be reached via Fairview Avenue. Access parking is also available at the end of Bridge Street in the vicinity of the old railroad bridge abutment. These parking areas can be connected to the river development by means of a jogging/walking trail.

Discussing future expansion plans with Mr. Sharpe, President of Whaling City (phone conversation 12/27/83) it was determined that within the next five years expansion of this facility may occur. The company would like to keep "all options open" and increase their water oriented activities.

Located beneath and immediately north of the Gold Star Bridge, Whaling City owns a parcel of land extending from the bridge north to the Providence and Worcester Railroad property below Fairview Avenue. Much of this land is undeveloped. Plans for expansion could include the use of this land and the possibility of using dredged material to create a man-made land area suitable for expanded access. This area could provide an additional 25,000 square feet of valuable space.



BOAT LAUNCH UNDER GOLDSTAR BRIDGE



LARGE CULVERT

AVAILABLE POINTS OF ACCESS TO THE THAMES RIVER

Wilbur Smith and Associates

FIGURE 12

Working in conjunction with Whaling City, and the City of Groton, the Town of Groton could either purchase, or be granted an easement on the northern-most portion of this land. A paved or gravel parking area accommodating 20-50 vehicles and a boat launch ramp could be constructed. Access to the parking area would be via Fairview Avenue with access to other proposed developments by means of the jogging trail north towards the overlooks, and south towards Bridge Street.

Access to the river development from the southern end of the study area would be via Bridge Street. Persons travelling northbound on I-95 would access the area via the direct connection to Bridge Street or via Route 12. Southbound I-95 traffic would use the Clarence B. Sharp Highway and then exit onto Bridge St. Route 12 and Thames Street also intersect Bridge Street. Vehicular access from Bridge St. to the study area would follow Fairview Avenue to Military Highway. Because of the ease of access to Bridge St. from major highways and Thames St., the southern end of the study area should become the primary route of access to the waterfront development.

The parking facility proposed near Whaling City would be connected to Fairview Ave. by a gravel or paved road leading up the riverbank to a point near Buell St. which also intersects Fairview Ave. Additional parking could be provided along Buell St. near the existing boat launch ramp or along Bridge St. The development of a large parking facility on Bridge St. should be considered to provide additional parking for the river front development and Nautilus Memorial as well as the revitalization along Thames St. in the City of Groton. The Town of Groton should negotiate with the City and cooperate to implement new or improve existing parking facilities in the area of Whaling City, Buell St., and Bridge St.

The City and Town should also consider developing a shuttle bus system from the potential parking areas on the southern end of the study area north to the Nautilus Memorial and south to Thames Street. This would reduce traffic congestion on Military Highway and Thames Street caused by tourist vehicles.

The development of a water taxi system used in conjunction with Scheme III dock development could provide an alternative means of vehicular access to the study area. The water taxi would provide a pleasing recreational mode of transportation connecting Thames Street with the riverfront development and the proposed Nautilus Memorial. This additional commercial activity would be privately owned and operated. The City and/or Town of Groton could opt to develop this activity. The water taxis would also provide an additional revenue source for the City and/or Town either directly through ownership and operation or, indirectly via taxes and docking charges.

A separate alternative for vehicular access was developed in conjunction with the river bank development. This alternative was composed of a bridge from Military Highway across the railroad tracks, and a road leading to a parking area built on dredged fill. This alternative was determined to be unfeasible due to construction costs and the environmental impacts associated with the filling in of a portion of the Thames River.

Future developments by Amtrak along the Providence and Worcester Railroad, in the form of Nautilus excursion trains, may also provide museum related vehicular access to the area. These excursion trains, if implemented, would increase the potential demand and use of the study area. The development along the Thames River could be highlighted as a beneficial sideline to the Nautilus Memorial. Also, if the railroad realizes that the proposed

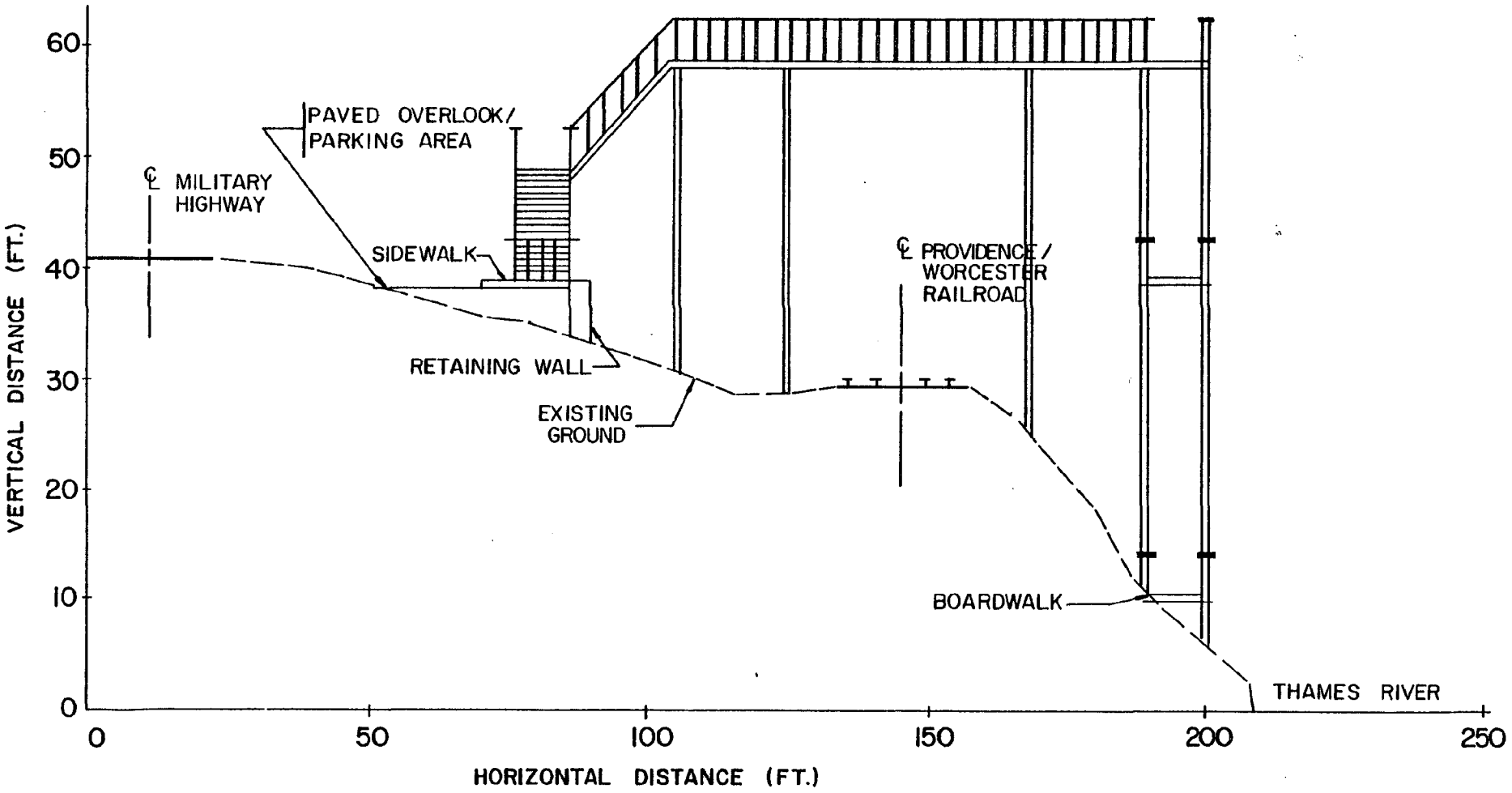
development would be beneficial to the marketing of such excursion trains, the railroad could become a source of additional funding and a means of promoting the area as well as providing an additional means of access to the area.

The inclusion of access to the trails from the railroad for pedestrian use may be desirable in the near future and could be accommodated at various points along the development area. One such point is near the large box culvert which passes underneath the railroad (Figure 12).

It was observed during several rain storm events that excess capacity exists in this culvert to allow for the design of safe passage for pedestrians on an elevated walkway.

III.2.B Pedestrian Access - Access by pedestrians should be conducive to vehicular access and major arterials for safety and convenience. The two parking areas are connected to the primary development sites by means of a jogging/walking trail. The trails are designed to afford access to all aspects of the site. This can be made possible by the use of an existing large box culvert as a pedestrian underpass under the railroad, to gain direct access to the shore from Military Highway. With the development of Scheme I, the culvert underpass is used to connect the two southern parking areas with the scenic overlook and picnic areas accompanying them. This alternative should provide access to the area for nearby residents.

Development of Scheme II can utilize the culvert for access to the boardwalk and jogging trail from the overlooks and picnic areas. The culvert may be used for handicap access as long as slopes along the trail are kept to a minimum. Additional pedestrian access to and from the boardwalk is provided by two overpasses of the railroad located at two of the overlooks. See Figure 13 for an illustration of a typical cross section of this alternative.



CROSS SECTION OF OVERLOOK AND BOARDWALK
(SCHEME II)

FIGURE 13

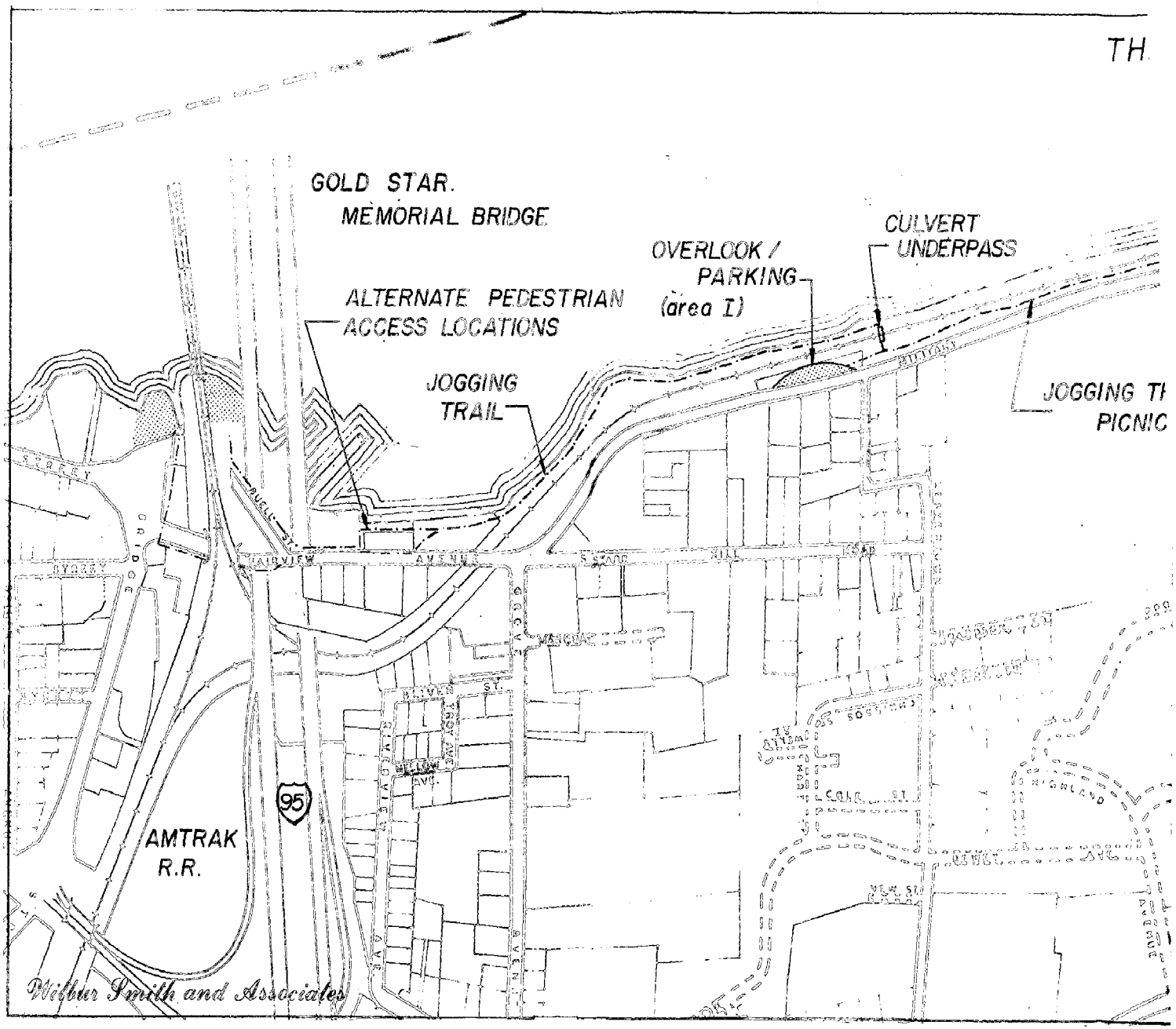
Use of the large culvert for pedestrian access to the shoreline would require further study to evaluate the feasibility of its use. A hydrologic study of the drainage area served by the culvert would be required to determine storm water flow through the culvert. The elevation and velocity of the storm water passing through the culvert would determine the height and design of the elevated walkway passing through the culvert. Prior to this evaluation, use of the culvert as a pedestrian access route should be restricted to protect the Town of Groton from potential liability for any accidents which may occur.

Figure 14 illustrates the different types and locations of access points to and from the Thames River development area.

The use of connecting trails and the overlooks offer full access to the development area. Appropriate connections can be made to the proposed Nautilus Museum once plans are finalized for railroad and roadway access. By making the area as accessible as possible and retaining an aesthetic surrounding, people will enjoy visiting and relaxing within the study area.

III.3 Alternative Development

The severe physical constraints characteristic of the study area were the primary cause of initiating a phased approach to development. The economic, environmental and aesthetic aspects of the development influenced the progression of the development. In addition, the development schemes were designed to interact with each other to form a whole and/or allow different aspects of each scheme to be interchanged with another. In other words, portions of one type of development for one scheme can be used in conjunction with or substituted for one or more portions of a separate development scheme. To provide this development


TH
GOLD STAR.
MEMORIAL BRIDGE
CULVERT
UNDERPASS
OVERLOOK /
PARKING
(area I)
ALTERNATE PEDESTRIAN
ACCESS LOCATIONS
JOGGING
TRAIL
JOGGING TI
PICNIC
AMTRAK
R.R.
95
Wilbur Smith and Associates

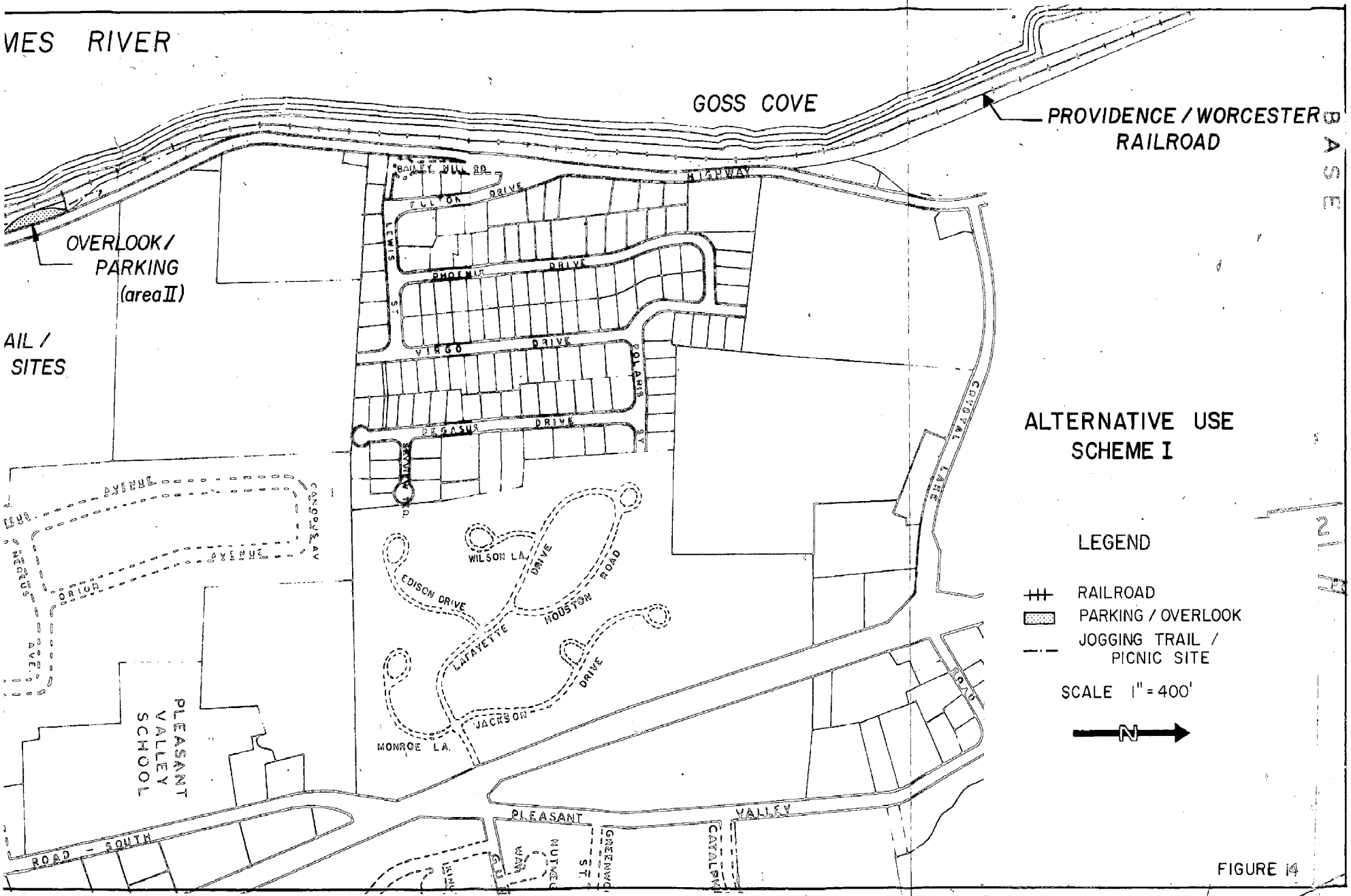

MES RIVER
GOSS COVE
PROVIDENCE / WORCESTER RAILROAD
OVERLOOK / PARKING (area II)
AIL / SITES
BASE
BAILEY MILL RD.
HIGHWAY
FULTON DRIVE
LEWIS ST.
PHOENIX DRIVE
VIRGO DRIVE
POLARIS
PEGASUS DRIVE
CRYSTAL LAKE
WILSON LA.
DRIVE
EDISON DRIVE
HOUSTON ROAD
LAFAYETTE
DRIVE
JACKSON
MONROE LA.
ROAD
PLEASANT VALLEY SCHOOL
ROAD - SOUTH
PLEASANT
VALLEY
ALTERNATIVE USE SCHEME I
LEGEND
RAILROAD
PARKING / OVERLOOK
JOGGING TRAIL / PICNIC SITE
SCALE 1" = 400'
N

FIGURE 14

characteristic, six categories of development, which provide a specific type of use of the study area, were identified. They were:

- o Commercial;
- o Recreational;
- o Land;
- o Water;
- o Active; and,
- o Passive.

These development categories were then used to maximize benefits to the study area by using existing land areas and/or new land area composed of dredged fill.

Utilizing the existing land area, passive, active, land, water, recreational and commercial development schemes were examined. The severe slopes, limited access, potential impacts (visual and environmental) and high construction costs created an unfavorable environment for commercial development on the existing land area. Therefore, commercial development in this scenario is not feasible. However, recreational development on the existing topography, although limited, was feasible.

Working with the physical constraints (slopes and access in particular) to minimize aesthetic and environmental impacts to the study area, potential recreational development sites were identified. Each site was then evaluated for its potential role in providing active and/or passive use of the environs. Where possible an active and a passive recreational facility using the land and/or water was developed and then all sites were interconnected to provide access. The passive development, such as jogging trails, picnic areas and overlooks, required light

construction with minimal impacts. Sites which provided active use of the study area and/or attempted to alleviate slope or access constraints required a higher degree of construction and hence, more aesthetic and environmental impacts and higher development costs.

Additional sites, where new land areas composed of dredged fill could be constructed, were identified. These sites could accommodate any of the six development categories mentioned earlier or any combination of the six. The location of the sites were dependent upon river bottom topography, foundation conditions, potential environmental constraints, how the site could be incorporated with previous development scenarios and/or alleviate development constraints imposed on the development of the existing land area.

All of the potential sites on existing and new land areas were then evaluated based on construction costs, environmental impacts, aesthetics and benefits to other development schemes and the study area as a whole. Despite being of benefit to the study area; commercial, the majority of the active and new land area development had the potential of causing severe environmental and aesthetic impacts as well as requiring complex and expensive construction. Therefore, it was determined that passive recreational uses and limited active recreational uses were more applicable and feasible for the study area. The passive and active recreational uses that were developed are discussed in more detail later in this chapter.

III.4 Dredged Fill Containment

A fourth scheme of development was also evaluated. This scheme would provide vehicular access from Military Highway

across the railroad tracks, by means of a bridge, to a man-made area of land near the point of land utilized in development scheme 3. This land area would be a shoreline expansion using dredged fill. A marina, restaurant, parking area and boat ramp would be developed on this new land area. Future expansion in size of the land area would accommodate the development of condominiums or other commercial activities associated with the river. An order of magnitude cost estimate of the initial development ranged from $20 to $30 million.

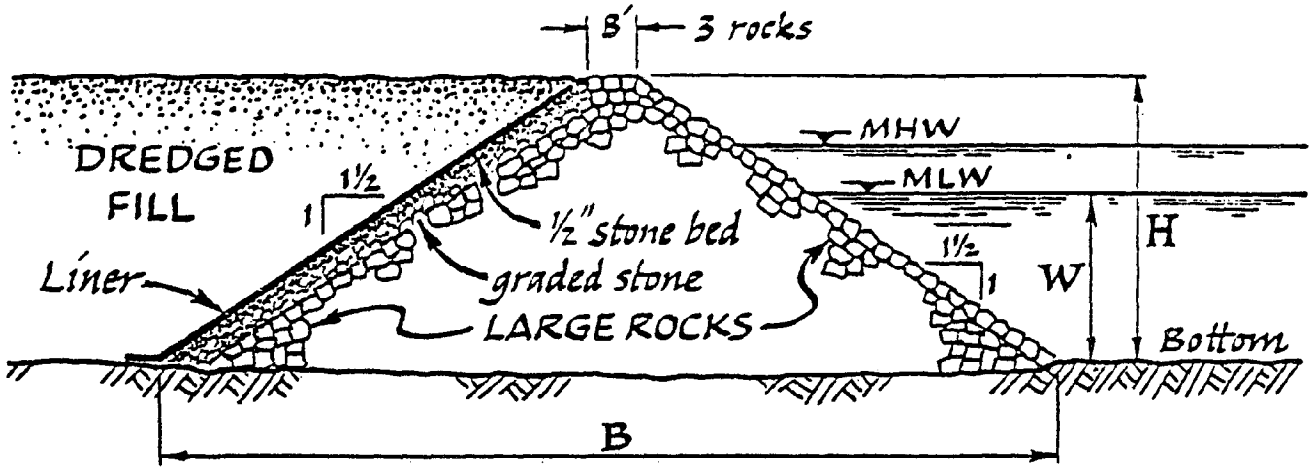
Several problems would be associated with this development. The dredged fill would have to be contained by a rock dike or sheet pile cofferdam. This would prevent erosion of the fill material caused by tidal movements, mitigate possible environmental impacts to neighboring areas and allow for proper consolidation and compaction of the fill material so that development could take place. The proposed land area would also be close to the existing channel which would limit the size or width of the new land area. A sheet pile cofferdam would be used to contain the fill because it requires the smallest width while the base of a rock dike would protrude into the channel. However, any development close to the channel would require evaluation by the Army Corps of Engineers and the U.S. Navy to determine any possible navigational hazards caused by the development.

River bottom foundation conditions would also be of concern. Using large scale marine charts, it was determined that the river bottom, along the study area shoreline, drops rapidly to channel depths of 35+ feet except in the immediate vicinity of Whaling City, Inc. Assuming that the fill would be placed out in the river to a depth of 12 feet, the maximum width of the fill area would be approximately 200 feet. The width of the

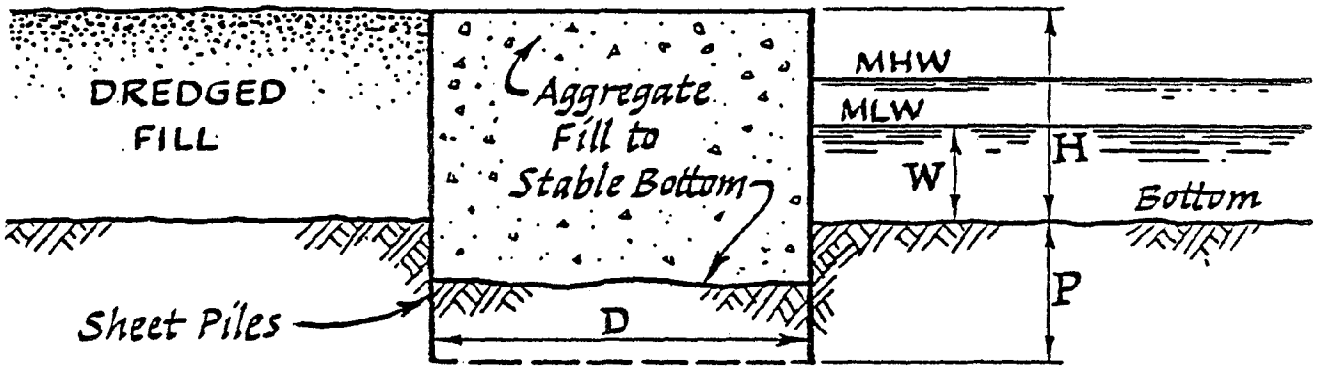
sheet pile cofferdam would use 40 percent of this available width. In order for the cofferdam to adequately contain the fill, the containment wall would require a stable foundation. Also, the height of the fill would be at least 20 feet above mean low water (to prevent flooding and storm damage) which would cause problems for marina development. (See Figure 15.)

The Army Corps of Engineers study "Long Island Dredged Material Containment Feasibility Study" identified dredged fill containment areas along the Thames River. However, the sites they identified were located on the New London side of the river. The Groton side of the river did not present a suitable area for a containment facility. These possible sites (on the New London side) extending from the Gold Star Bridge northward past the U.S. Coast Guard Academy to Mamacoke Cove were investigated. These sites were shoreline extensions in shallow water with relatively flat or gently sloping river bottom topography. Preliminary analyses produces promising results, however, each site was eventually dropped from consideration because of environmental, economics and/or bottom foundation problems. The foundation and environmental problems could be solved but only at tremendous costs (phone conversation with Richard Quinn, Army Corps of Engineers on February 14, 19

The evaluation of the New London sites can be corrolated to the Groton site proposed by development Scheme 4. Potential environmental, economic, navigational and foundation problems can be expected to develop at the proposed Groton site as they did with the New London sites. Because of the river bottom topography, existing shellfish concentrations and proximity to the channel, the problems on the Groton side of the river could be more severe than those encountered at the New London sites. Because of the potential severity of these problems and the



Cross Section of Rock Dike



Cross Section of Sheet Pile Cofferdam

Dimension	Shoreline	Nearshore	Offshore
H	23′	32′	56′
W	3′	12′	32′
B	77′	104′	176′
D	54′	78′	138′
P	15′	32′	40′

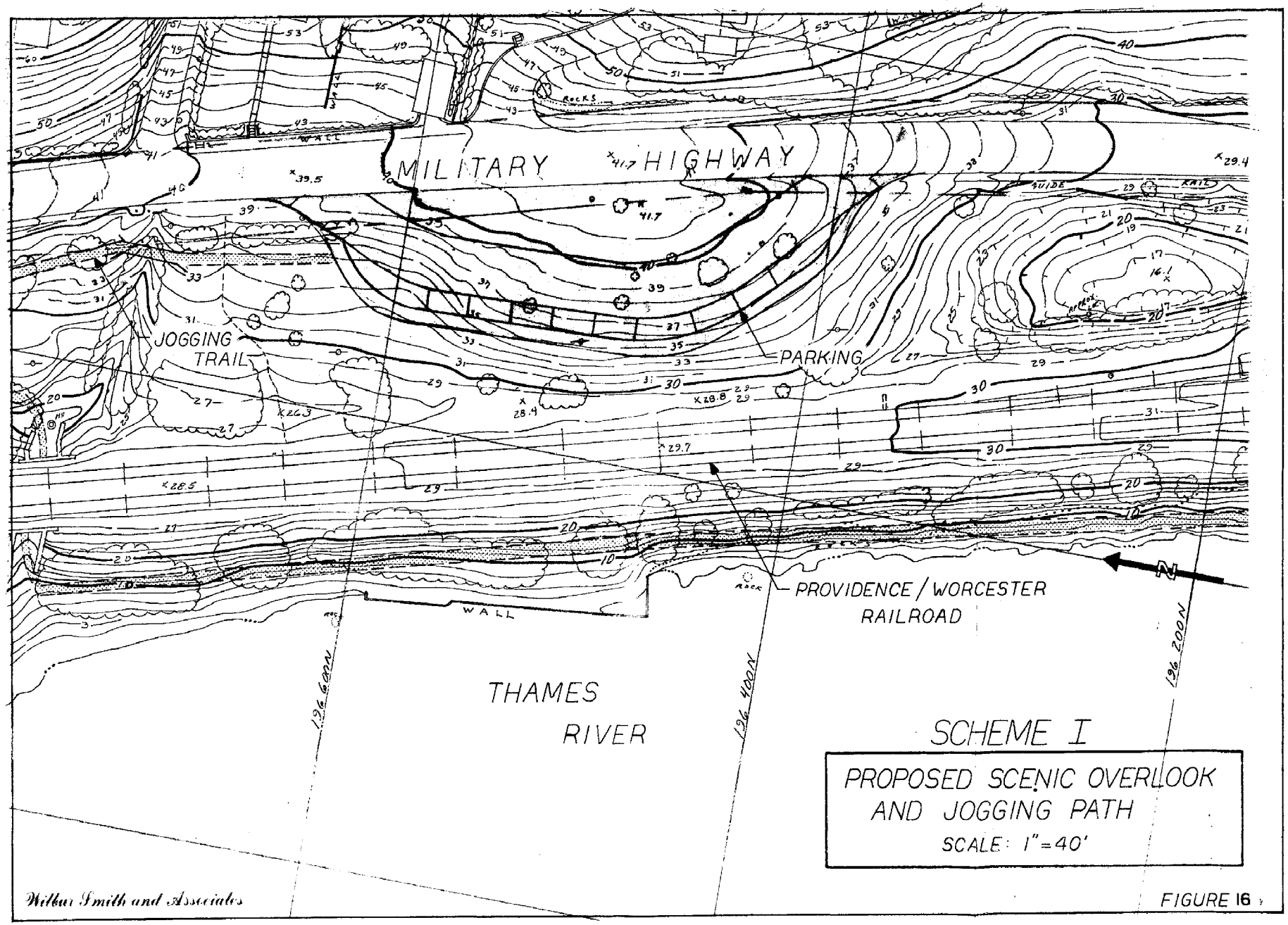
Rock dike and sheet pile cofferdam cross sections.

Figure 15

high development costs involved, development scheme 4 was dropped from further study.

III.5 Alternative Use Schemes

III.5.A Scheme I - This scheme proposes a minimal amount of development along Military Highway (see Figure 14) which would have an estimated cost between $660,000 and $900,000. Cost estimates for some or all schemes include the following items: retaining wall and overlooks, asphalt, gravel base course, barrow, sidewalk, wooden deck, picnic facilities, clearing, grading, planting, seeding, tables, trash recepticles and a jogging trail with gravel cover. There are no right-of-way or acquisition costs included in these estimates. Improvements made adjacent to the roadway would include two small scenic overlooks with parking spaces provided at each location. The proposed sites are situated between Military Highway and the Providence and Worcester Railroad. Each has a buffer of vegetation of approximately 30 to 40 feet between the edge of the overlook areas and the railroad tracks creating an aesthetically pleasing view from the road. The first overlook is located approximately 1,400 feet north of the Military Highway/Fairview Avenue intersection (Figure 16). At the second overlook area, which is 1,600 feet north of the first, a more elaborate scenic viewing area is proposed. A wooden deck would be located on the northwest corner of the overlook which could also be utilized as a picnic or resting site in close proximity to one's vehicle (see Figure 17).


MILITARY HIGHWAY
JOGGING TRAIL
PARKING
PROVIDENCE / WORCESTER RAILROAD
THAMES RIVER
WALL
SCHEME I
PROPOSED SCENIC OVERLOOK AND JOGGING PATH
SCALE: 1"=40'
Wilbur Smith and Associates
FIGURE 16

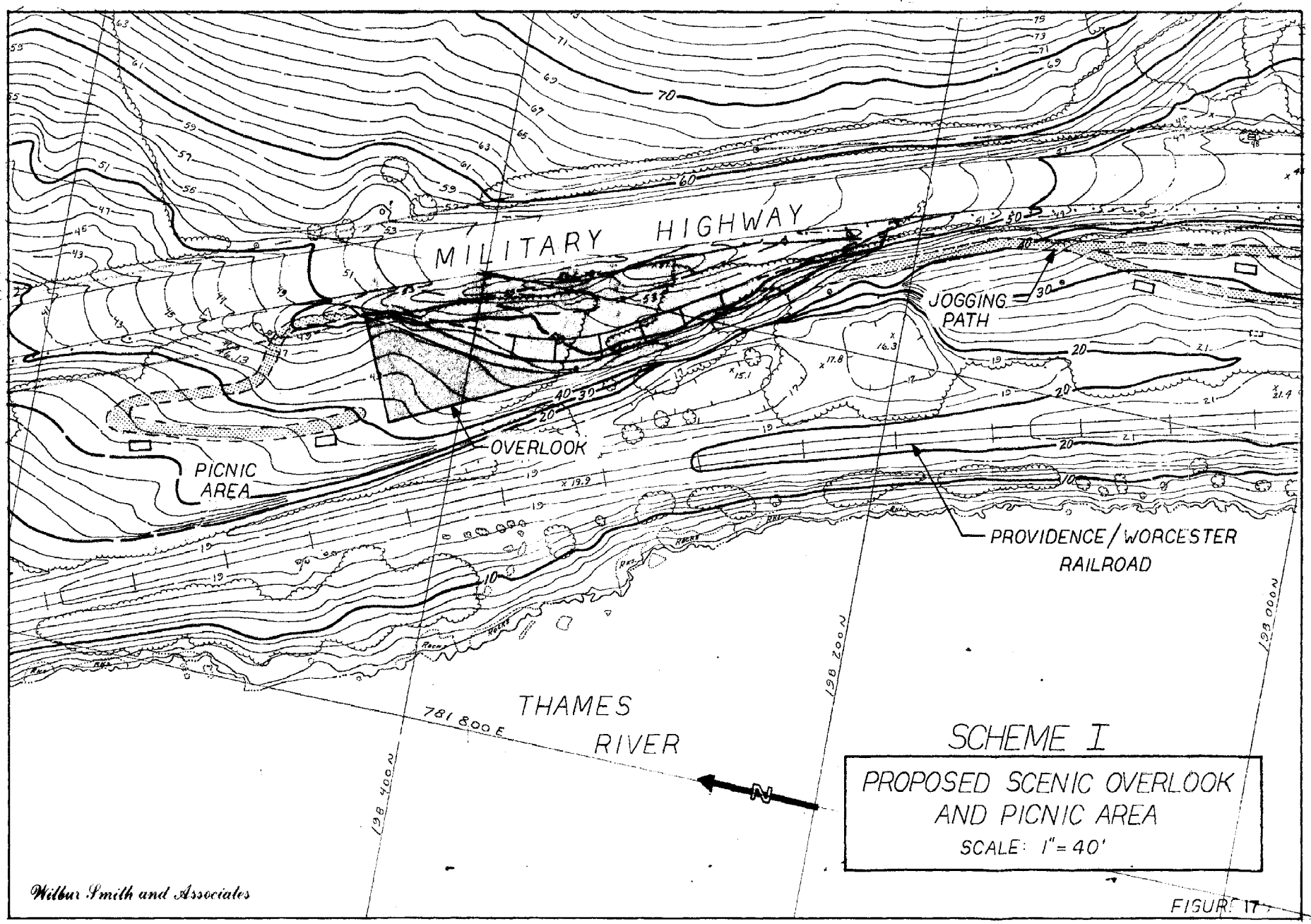

MILITARY HIGHWAY
JOGGING PATH
OVERLOOK
PICNIC AREA
PROVIDENCE / WORCESTER RAILROAD
THAMES RIVER
781 800 E
198 400 N
198 200 N
198 000 N
N
SCHEME I
PROPOSED SCENIC OVERLOOK AND PICNIC AREA
SCALE: 1" = 40'
Wilbur Smith and Associates

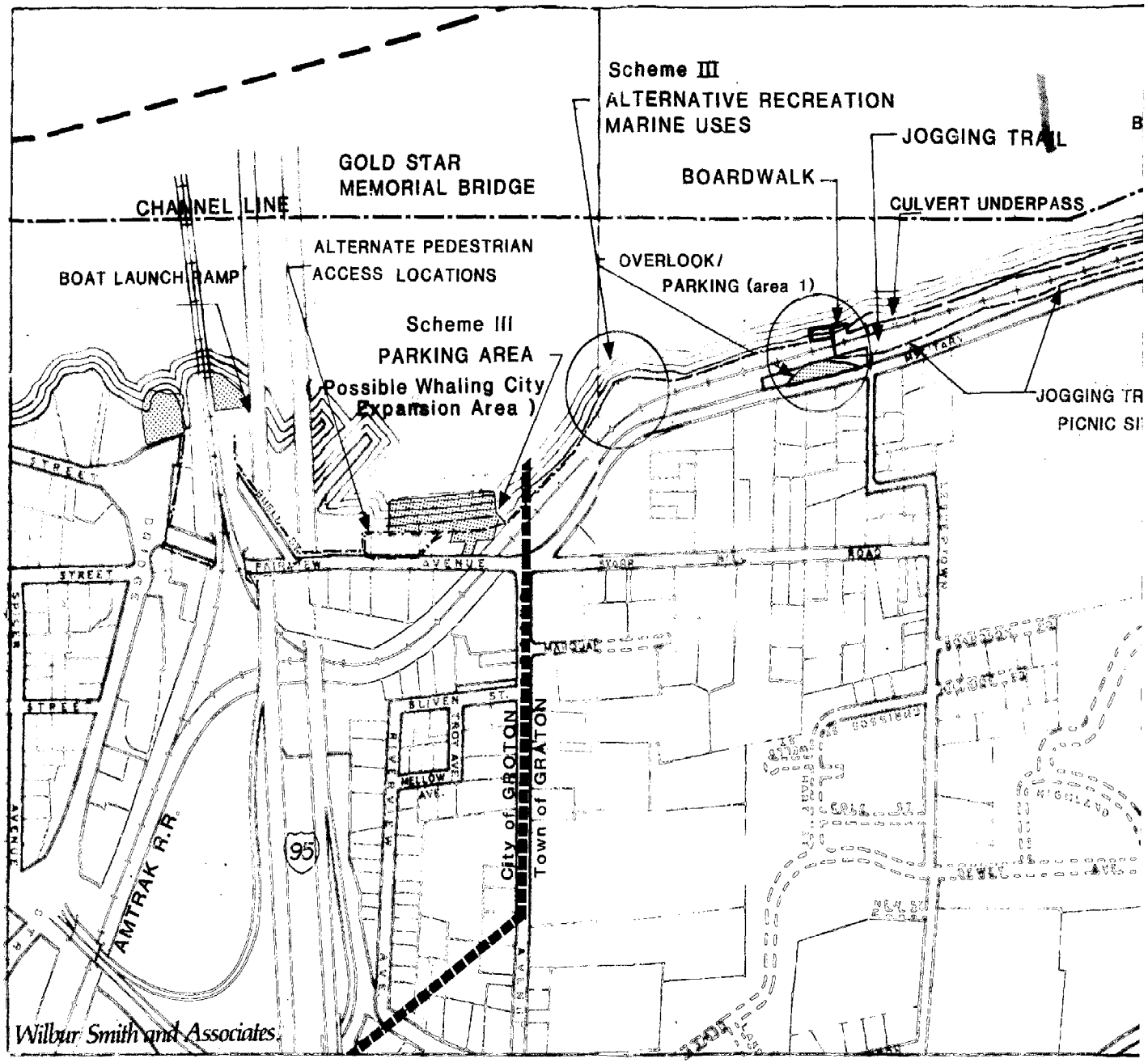
FIGURE 17

As part of the passive recreational opportunities developed in this scheme, a five-foot wide nature/jogging trail would begin south of the first pulloff area where pedestrian access could be gained. This trail could run along the shorefront and utilize the large culvert to tie in with the trail located parallel to Military Highway between overlook areas I and II (see Figures 14 & 16). Picnic tables would be situated along this route at isolated areas where excessive slopes would not be a limiting factor.

Overlook areas would require the extensive use of retaining walls as a result of the steep slopes. Vegetation in this area must be removed, and cut and fill operations would be necessary to provide a smooth grade in the parking areas. Initial removal of vegetation during construction may require the utilization of protective erosion measures while the soils are in a bare exposed state.

The trail will also require removal of vegetation which can be kept to a minimum if it follows the existing topography. Picnic areas would require extensive clearing of trees and undergrowth, particularly in areas where earth work would be needed to provide a level surface.

III.5.B Scheme II - In scheme II a more extensive plan for development of the waterfront area has been studied. The main features of this scheme include: three overlook/parking areas; a jogging trail which runs along the coast and the highway, and provides isolated picnicking sites; and a boardwalk along the shoreline which would be accessible from two of the overlook/parking stations. An estimated range of cost for the implementation of this scheme is from $1,800,000 - $2,600,000. Refer to Figure 18 for the location of the proposed site developments described below.


Scheme III
ALTERNATIVE RECREATION
MARINE USES
JOGGING TRAIL
BOARDWALK
GOLD STAR
MEMORIAL BRIDGE
CHANNEL LINE
CULVERT UNDERPASS
ALTERNATE PEDESTRIAN
ACCESS LOCATIONS
BOAT LAUNCH RAMP
OVERLOOK/
PARKING (area 1)
Scheme III
PARKING AREA
(Possible Whaling City
Expansion Area)
JOGGING TR
PICNIC SI
AVENUE
STREET
BLIVEN ST
MELLOW AVE.
City of GROTON
Town of GRATON
AMTRAK R.R.
95
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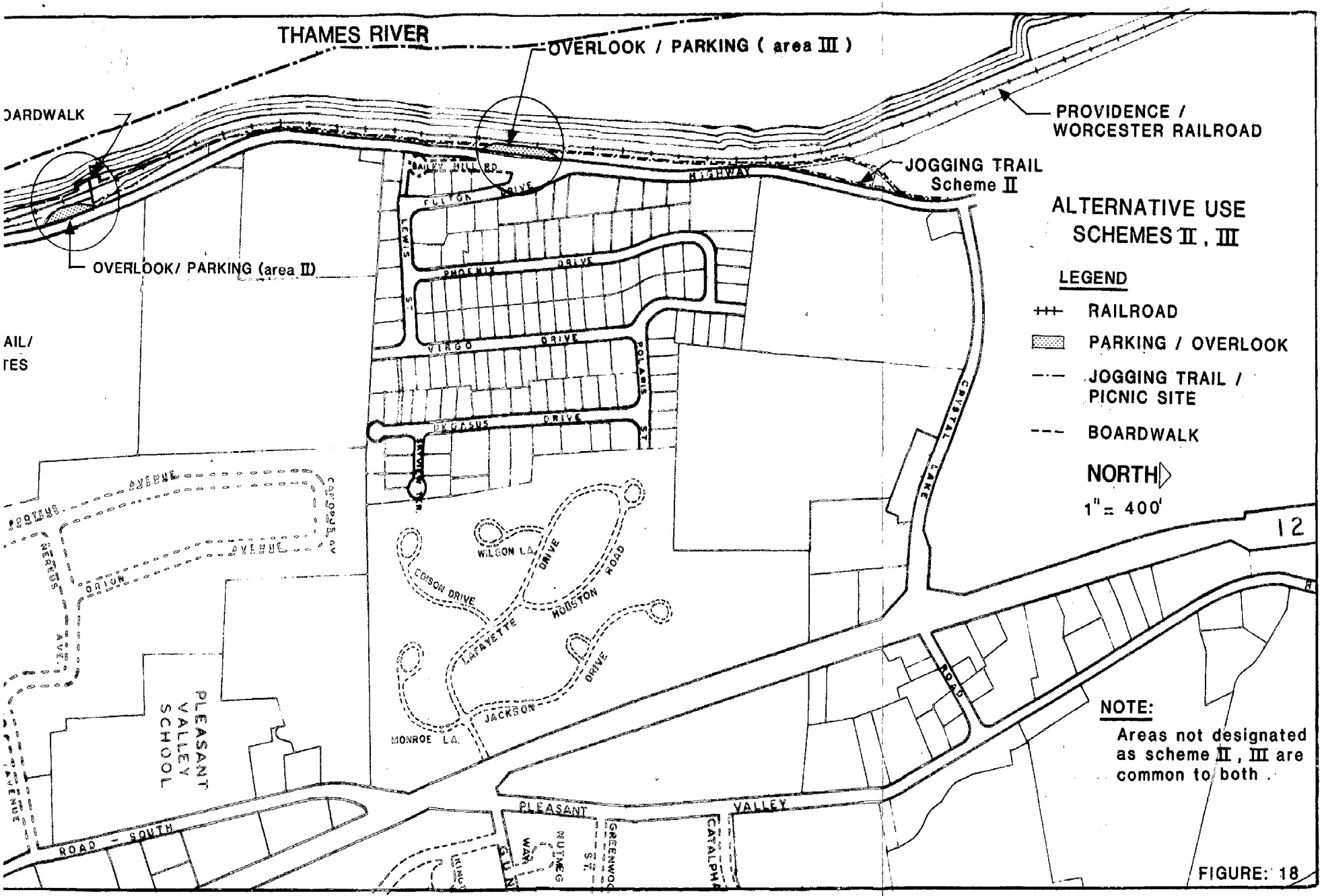

THAMES RIVER
OVERLOOK / PARKING (area III)
PROVIDENCE / WORCESTER RAILROAD
JOGGING TRAIL Scheme II
OVERLOOK/ PARKING (area II)
ALTERNATIVE USE SCHEMES II , III
LEGEND
RAILROAD
PARKING / OVERLOOK
JOGGING TRAIL / PICNIC SITE
BOARDWALK
NORTH
1" = 400'
NOTE:
Areas not designated as scheme II , III are common to both .
PLEASANT VALLEY SCHOOL
PLEASANT VALLEY ROAD - SOUTH
WILSON LA.
COLSON DRIVE
HOUSTON ROAD
LAFAYETTE DRIVE
JACKSON
MONROE LA.
PHOENIX DRIVE
VIRGO DRIVE
PEGASUS DRIVE
LEWIS ST.
POLARIS ST.
CRYSTAL LAKE ROAD
12

FIGURE: 18

Overlook areas in this scheme are similar to those presented in Scheme I, with a third larger overlook/parking area planned north of the other locations, approximately 100 feet south of the Military Highway/Fulton Drive intersection. A five-foot wide jogging trail begins near the Gold Star Memorial Bridge which extends north to the intersection of Military Highway and Crystel Lake Road. This nature/jogging trail is interconnected with the overlook/parking areas as in Scheme I, and extends north of the third parking area located in this scheme. Picnicking areas are also located along the jogging trail.

Another major feature of this scheme is a 10-foot wide boardwalk which is accessible from the two southernmost parking areas via a wooden pedestrian overpass crossing the railroad tracks. The substructure of the overpass should be steel to bridge the wide gap across the Providence and Worcester Railroad. The entire length of the boardwalk is approximately 2,400 feet and would be located about 10 feet above water level where it runs parallel with the coastline. Scenic platform areas for viewing the vista are located near the access points to the boardwalk. Figure 19 illustrates the placement of the boardwalk and its access from overlook area II. (Refer to Figure 13 which illustrates the cross section of the proposed pedestrian overpass.) Construction-related impacts will be the same as those incorporated in Scheme I, but will be more extensive because of the broader development proposed for overlook and jogging areas. The plans for a boardwalk may require the use of pilings in some areas and the topping of trees to provide a scenic view of the river and the Coast Guard Academy. Extensive clearing of vegetation and earthwork would be needed because of its location, necessitating the strict implementation of erosion control measures to minimize adverse impacts to the river from adjacent construction activities.

III.5.C. Scheme III - A more extensive plan for development of the waterfront, scheme III offers additional recreational facilities which directly involve the Thames River. Scheme III development is similar to Scheme II and will utilize the small point of land between the railroad and the river located approximately 800 feet north of the Fairview Avenue railroad overpass. This area has the potential for a variety of marine/recreational opportunities. There is a possibility that a floating dock system could be constructed as well as a 100-foot long fishing pier and a picnic/park area. The ultimate length of the docks and fishing pier would be dependent on the Army Corps of Engineers and U.S. Navy permits and requirements. The docks should be removable so that they could be disassembled during winter months when recreational use of the river drops dramatically and to protect the docks from possible ice flows. A floating dock system could also handle tidal fluctuations, "ride out" storms, and provide easy maintenance or replacement. Figures 18 and 20 illustrate the locations of these facilities. All of the facilities associated with this scheme are linked with the boardwalk, overlooks, picnic areas and jogging trails of Scheme II by utilizing the box culvert as a pedestrian underpass of the railroad. The estimated cost of this development ranges from 2.0 to 2.8 million.

The fishing pier and docks associated with this development scheme could be privately constructed, operated, and maintained. However, making these facilities a commercial venture may detract from the potential water dependent recreational benefits which the pier and docks offer the study area. For example, fisherman would tend to fish from the shoreline rather than pay a fee for using the pier. A more suitable commercial development would be a small bait and tackle shop or stand near the fishing pier. Because of the potential detraction from the waterfront area

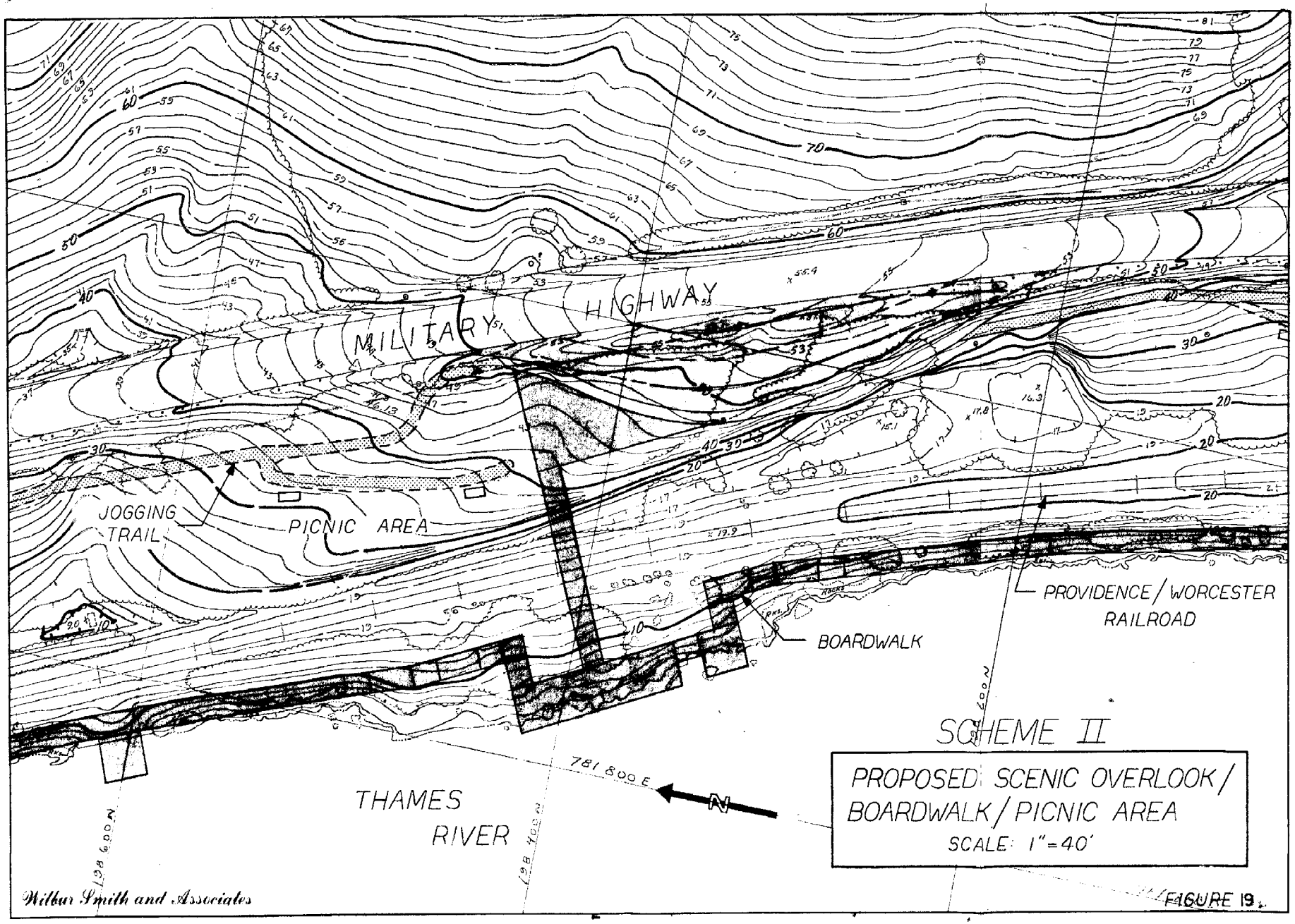
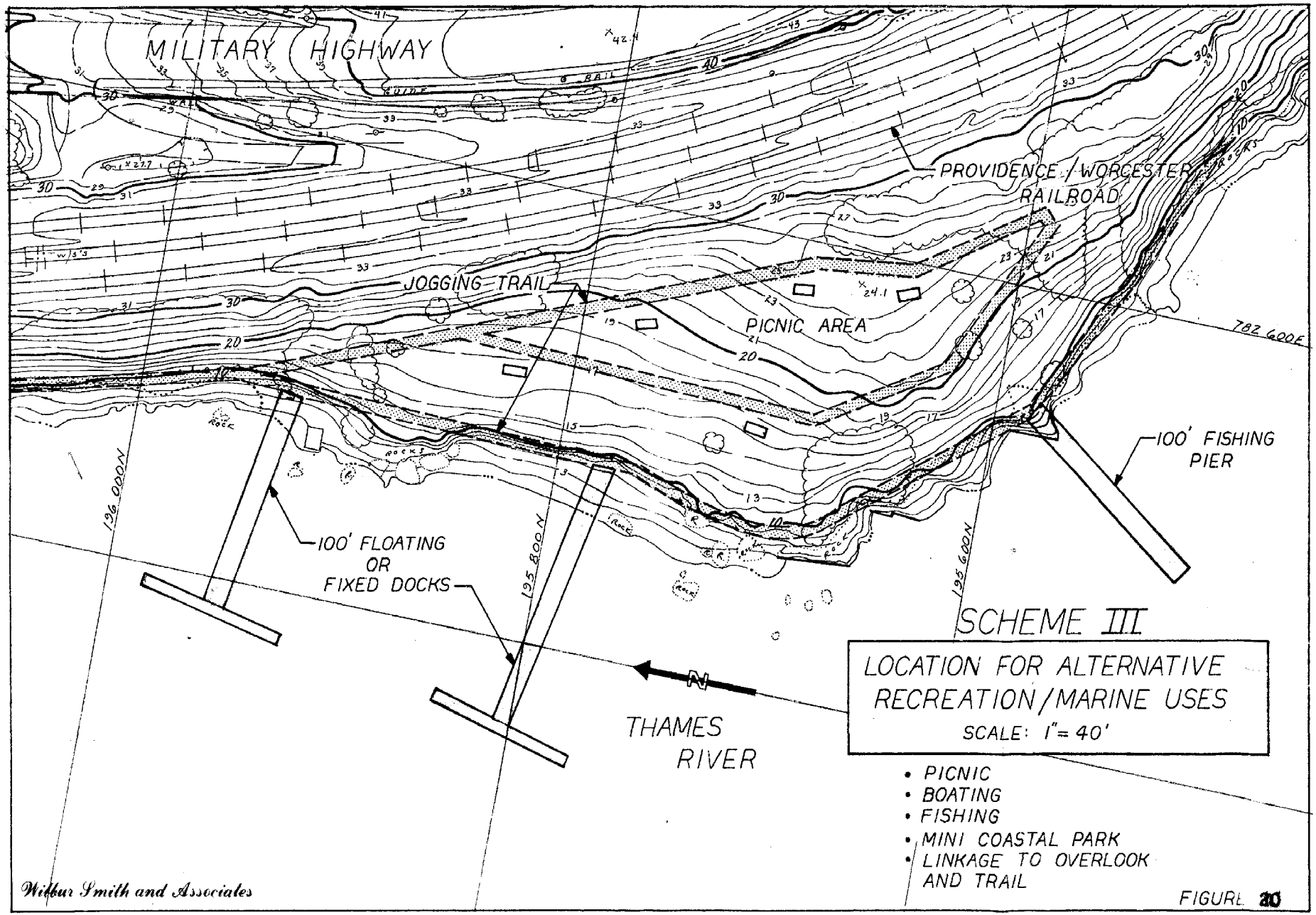

MILITARY HIGHWAY
JOGGING TRAIL
PICNIC AREA
PROVIDENCE / WORCESTER RAILROAD
BOARDWALK
THAMES RIVER
781 800 E
N
SCHEME II
PROPOSED SCENIC OVERLOOK / BOARDWALK / PICNIC AREA
SCALE: 1"=40'
Wilbur Smith and Associates

FIGURE 19


MILITARY HIGHWAY
PROVIDENCE / WORCESTER RAILROAD
JOGGING TRAIL
PICNIC AREA
100' FISHING PIER
100' FLOATING OR FIXED DOCKS
196 000N
195 800N
195 600N
782 600E
THAMES RIVER
SCHEME III
LOCATION FOR ALTERNATIVE RECREATION/MARINE USES
SCALE: 1"= 40'
• PICNIC
• BOATING
• FISHING
• MINI COASTAL PARK
• LINKAGE TO OVERLOOK AND TRAIL
Wilbur Smith and Associates
FIGURE 20

caused by private commercial ownership, the pier and dock facilities should be municipally owned, maintained, and open to the public free of charge. However, thought should be given to charging a docking fee to commercial boating (i.e., river tour boats) who desire to use the developed waterfront areas as an added attraction to their services.

Additional parking could be provided below the Fairview Avenue Bridge. This parking area would be accessed by vehicles via a paved road leading up the riverbank to a point near Buell Street. This would entail the purchase or the granting of an easement through property owned by Whaling City, Inc., as well as coordination with the City of Groton. Access to the remaining recreational facilities would be provided by the jogging trail which extends northward to the overlooks, boardwalk and picnic areas, and south to Bridge Street. The inclusion of a boat ramp and/or fishing pier at this location is also a possibility. However, this development potential will hinge on negotiations with and plans for expansion by Whaling City, Inc. Figure 18 illustrates the location of the parking area and areas of potential development by Whaling City, Inc. The cost of this additional development is dependent upon Whaling City, Inc. Because of the multiple methods or schemes of development in this area, the cost of the development varies greatly. Depending on the extent and method of development and acquisition of the land, the cost will range from a low of approximately $50,000 to a high of $200,000. This cost would be additive to the cost for Scheme III which was stated earlier.

Construction related impacts will be the same as those associated with Schemes I and II. Impacts to the Thames River may result from the construction of the docks and fishing pier.

Potential impacts which could occur are:

- Temporary increase in turbidity levels during construction;
- Disruption to aquatic habitats; and,
- Disturbance of open water areas.

However, these impacts can be alleviated through the implementation of proper construction techniques and monitoring mitigation measures.

Chapter IV

CONSISTENCY WITH STATE, LOCAL AND REGIONAL PLANS

This chapter discusses the consistency of the study with state, local and regional plans. The history of coastal development in the northeast has shown that it is important to be consistent with state plans which provide overall direction and management objectives. It is also beneficial to be compatible with the plans of adjoining towns which may be affected by changes to the coastline. However, this coordination in other communities has not always been successful. To a lesser extent, regional plans for resource management in the northeast have been shown to be a positive strategy, but implementation has been poor because of local and jurisdictional controls. This chapter presents a summary of selected plans and their consistency with this study.

IV.1 State Plans

The most significant state plan associated with this project is the State of Connecticut Coastal Area Management Program. This study is consistent with this plan because it provides for beneficial uses of the shoreline and adjacent areas without creating impacts which would be deleterious to the ecology of the Thames River and the coastal zone. Positive benefits would be accrued since the enhancement of natural resources would be achieved, while at the same time preserving the integrity and individual nature of this part of the coast. Once an alternative use scheme is selected more specific details would be available and a site review could be made to quantify development related impacts.

IV.2 Local Plans/Regulations

The Town and City of Groton have municipal plans and regulations which relate to the Thames River area in a variety of ways.

The Town of Groton has the primary responsibility for the study area because of its inherent regulatory powers. The Zoning Regulations for the Town (amended August 1983) have identified allowable uses as shown on the Zoning Map. The study area is zoned as Residential (R-12), with a small section classified as multiple-family (RMF). Some of the options shown in the three development schemes would need rezoning to allow for the orderly growth and development of the study area and the adjacent environs. Specific zones of importance would be commercial, retail and waterfront. This study suggests that because of the coastal constraints along the study area that changes to existing zoning designations be carefully assessed to ensure compatibility with the intent of land use policies.

In Chapter II.4.B, the Town's Municipal Coastal Program was discussed and the proposed development schemes would be consistent with this plan. One of the interests of the Municipal Coastal Program was to enhance general public access. This study has tried to maximize the utilization of available resources because of an acute access problem. Groton has a significant coastline but because of a physical constraint, is unable to utilize the associated coastal benefits. This plan presents one approach to solve that problem and be considerate of the environmental constraints. Positive benefits with this plan would include:

- Promoting the passive use of the shoreline;
- Gaining new access to the coast;

- o Preserving coastal amenities; and,

- o Enhancement of coastal resources.

The Town also has a Bikeway plan which designates Military Highway as an established route under Phase 3 of the program. The limitations of width and geometry of Military Highway make a bike path unfeasible under present conditions. Bikers would be encouraged to come to the Thames River area and leave their bikes and walk or picnic.

The City of Groton has prepared a study entitled the Thames Street Study, 1982, which presented alternative scenarios for Thames Street, which is a major link between the City and Town of Groton. The study recommended a series of coastal policies which would benefit the Thames Street district with the following measures:

- o Revitalization of the economic base of the street in a manner which preserves its historic charm;

- o Expansion of waterfront access and use in commercial areas;

- o Restriction of visitor parking and traffic along Thames Street with tourist access to be provided by public transportation.

Major findings of the study's inventory work indicated that access constraints, disorganized land uses and a poor image represent interrelated problems that must be overcome to achieve revitalization. Three scenarios were developed to improve the future of the area.

- Scenario 1: Improving the Image -- focuses on upgrading water edges, enhancing the setting and appearance of existing buildings, and developing additional housing at gateways to the street;

- Scenario 2: Linking Resources -- emphasizes capturing the tourism potential of the USS Nautilus by developing a ferry service to Thames Street sites and making them part of the attraction; and,

- Scenario 3: Consolidating Activities--illustrates how predominant uses in the district might be organized and concentrated to create more powerful magnets for private investment, tourism, and marine uses.

The Town's plan for improvements along their shoreline complement the City's desire to improve the image of Thames Street. The City of Groton has proposed positive marine and recreational uses which will help integrate the uses and aesthetics of this coastline.

IV.3 Regional Plans

An Action Plan for the Development of the Thames River Area was prepared in 1980 by the State of Connecticut Office of Policy and Management in order to develop a regional organization to link the eight towns along the Thames River. The principal target goals of the plan are to:

- Implement a major marketing program for the State Pier;
- Completion of an integrated tourism and recreational network for the Thames Region; and,
- Substantial creation of job opportunities in the Thames Region.

Specific actions were recommended for the Thames which are complimentary to the findings of this study. These actions are as follows:

- Negotiate with railroad companies (Central Vermont, Providence and Worcester) to schedule passenger service and necessary facilities (cars and platforms) at appropriate sites along the right-of-way ;
- Negotiate with transit systems for scheduled service at appropriate sites;
- Negotiate with excursion boat operators for boat transport along river;
- Negotiate with property owners for development of landing facilities for boats.

(Note: Landing/Docking facilities for private boats for picnics may be included).

The Regional Transportation Plan for Southeastern Connecticut (1983) has recommended that Military Highway be reconstructed from the Sub Base to I-95. This improvement is greatly needed and has been recognized by the Town of Groton as a major constraint in the development and improvement of the area.

A review of pertinent state, local, and regional plans has found that the proposed alternative uses would be consistent and compatible.

Chapter V
FEASIBILITY OF IMPLEMENTATION

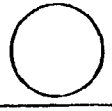
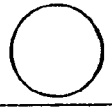
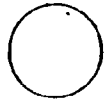
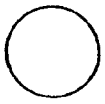
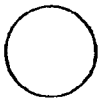
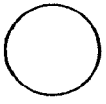
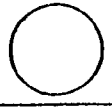
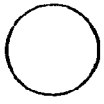
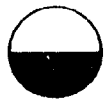
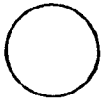
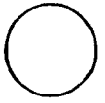
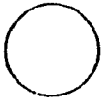
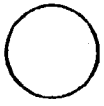
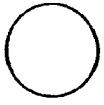
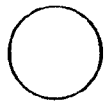
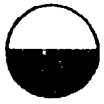
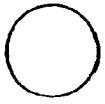
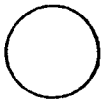
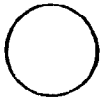
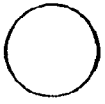
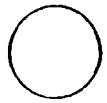
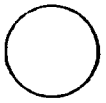
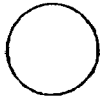
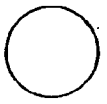
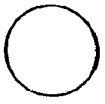
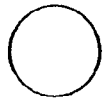
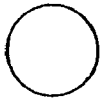
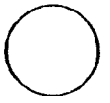
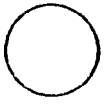
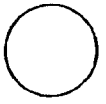
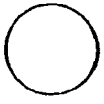
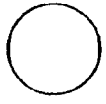
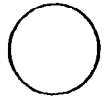
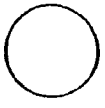
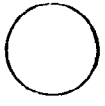
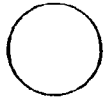
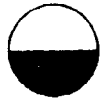
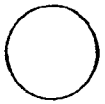
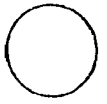
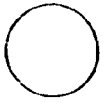
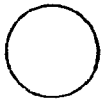
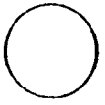
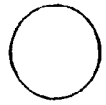
This chapter will discuss the feasibility of implementing the plans proposed in this study.

Implementation of a plan relies on the coordination of many variables which make a series of actions progress into reality. The greatest stimulus for improvements along the Thames River in Groton is the development of the USS Nautilus Memorial and Submarine Force Museum. This activity has the promise of stimulating the local economy and making public and private sectors anxious to improve the related shoreline and land areas. The Nautilus attraction may provide an incentive for the Providence and Worcester Railroad to increase excursion trips to the Nautilus and other tourist/recreational activities. There is indeed the potential for creating rail related activities along the study area which can be consistent with the MCP and can help to enhance the attractiveness and viability of the shoreline.

The three alternative use schemes proposed can be implemented in phase in order to be able to make some immediate changes, while other improvements may require additional funding and coordination through state and local initiatives.

The eventual construction of the schemes may be a function of the physical constraints present on the site. Figure 21 and 22 illustrate that Scheme 1 will cause the least amount of impacts, but will have severe parking and access constraints because of the less drastic improvements proposed. Schemes II and III have the greatest impacts to the natural environment because of the more drastic modifications to the shorelands between the Thames River and Military Highway consisting of greater habitat disturbance and earth removal.

SUMMARY OF PHYSICAL IMPACTS AND CONSTRAINTS FOR ELEMENTS OF DEVELOPMENT

ELEMENTS OF DEVELOPMENT SCHEMES	IMPACTS				CONSTRAINTS			
	EARTHWORK	VEGETATION	EASE OF CONSTRUCTION	IMPACTS TO RIVER	LEDGE ROCK	RAILROAD	FLOODING	SEVERE SLOPES
OVERLOOKS								
JOGGING TRAILS								
PICNIC AREAS								
WHALING CITY PARKING AREA AND BOAT LAUNCH								
BOARDWALK								
FISHING PIER AND DOCK								
PARKING AREA AT BRIDGE STREET								
MILITARY HIGHWAY IMPROVEMENTS								
CULVERT USE								

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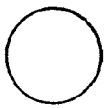 — LOW

 — MODERATE

 — SEVERE

Figure 21

SUMMARY OF PHYSICAL CONSTRAINTS-- ALTERNATIVE SCHEMES

SCHEME	SEVERE SLOPES	IMPACTS TO RIVER	EARTH-WORK	AES-THETICS	LEDGE/ ROCK	VEGE-TATION	RAILROAD	PARKING	ACCESS	EASE OF CONSTRUCTION
I	○	○	○	○	◒	○	○	●	●	○
II	◒	◒	◒	◒	◒	◒	○	◒	◒	◒
III	◒	●	●	◒	●	●	○	○	○	●

LEVELS OF CONSTRAINT

LOW – ○

MODERATE – ◒

SEVERE – ●

Wilbur Smith and Associates, Inc.

FIGURE 22

The three schemes have been proposed with their relation to cost, and degree of complexity. It is suggested that a phased approach to development be encouraged for this project since many of the improvements can be independently added. Table 3 presents a suggested approach for phased development. The development presented in this table would proceed from minimal passive recreation facilities to active, yet limited, water and land recreational activities. The extent and timing of the development should be closely coordinated with the Nautilus Memorial and Thames Street development. The end product of all the development would produce an aesthetic atmosphere along the Thames River conducive to attracting local residents and tourists to the commercial and recreational resources provided by the Thames River. It must be stressed again that improvements to Military Highway are essential for the future success of this area. The following summary highlights the differences in these schemes.

Scheme 1 - Passive aesthetic improvements, overlook areas, access achieved by pedestrian walkway from boat ramp and Bridge Street;

Scheme 2 - Boardwalk along the shoreline, extension of trail to Crystal Lake Road, pedestrian overpass to allow crossing of railroad to shore, use of culvert for pedestrian access;

Scheme 3 - Improvements presented in schemes 1 and 2 with potential use of the river for marine related recreational uses (fishing, boating).

Table 3

PHASING OF DEVELOPMENT SCHEMES

SCHEME	I	II	III
Improvement to Military Highway	1	1	1
Overlook I	2	2	2
Overlook II	2	2	2
Jogging Trail between Overlooks I and II w/Picnic areas.	2	2	2
Jogging Trail, south to Bridge Street w/Picnic areas.	3	3	3
Jogging Trail, north to Crystel Lake Road w/Picnic areas.		3	3
Overlook III		3	3
Boardwalk		4	4
Docks and Fishing Pier, related trails and picnic areas.			4
Parking lot and access road near Whaling City.			4
Boat launch at parking area.			4
Parking area at Bridge Street	3	4	5

NOTE: 1 - Highest Priority; 5 - Lowest Priority.

Figure 22 identifies the proposed activities by individual schemes. The more aggressive options are suggested for Schemes II and III, while more passive activities are available in Scheme I. Variations in possible activities can be developed with all the schemes.

Implementation of these schemes will depend on the availability of funding to create new points of access and to provide a source of revenue for physical improvements. The Town of Groton will need to assess the viability of allocating funds to this project with the aim of providing better residential recreation opportunities, while at the same time enhancing tourist-related enterprises. How can the Town proceed with this project without making large outlays of funds? The following strategies can help to guide the Town in this ambitious project.

Secure Federal and Other Grants for Physical Improvements

Even within the tight budgets of most federal departments there are still funds available for projects such as the Thames River study. The National Endowment for the Arts (Architecture and Environmental Arts Division) offers grant awards for vegetative planting, green spaces, and improvement of river and stream corridors. Completed projects from this fund include green space improvements in South Portland, Maine, where there was a design developed for a waterfront greenbelt linking a public beach, a vocational school, several historic sites, and a proposed marina. Also, in Elkhart, Indiana, a study was conducted with this same funding for river and stream corridors. Included was a land use feasibility study, construction cost estimation program, and cost implementation plan. Emphasis was placed on walking and bicycle paths, and other water oriented activities.

The Federal Highway Administration, through the Federal Aid Highway Program, Department of Transportation, provides funding for municipalities for bicycle paths, pedestrian walkways, and parking facilities. In addition, the Urban Mass Transportation Administration, Department of Administration, provides funding which would be applicable to certain aspects (transportation) of the suggested study schemes.

Also, the National Park Service, Department of the Interior, sponsors programs to encourage bike trails, boat launching, and access roads. This funding source is even more applicable because of the proposed Nautilus work and great recreational prospects for the area.

The State of Connecticut should also be urged to dedicate funds to the Thames River area because of the tremendous opportunities for local and tourist use of the coast. Meetings should be scheduled with the Departments of Transportation, Environmental Protection, and Economic Development, to evaluate potential funding sources. Funds could also be possibly obtained from the State Coastal Management Office through their various funding programs.

A concern to many municipalities is the cost of maintenance and operation of a facility. All too often projects are constructed, but are unable to keep within the intent of their original plan because operational fees were not considered. With this in mind, it is suggested that user fees be considered for the various schemes presented in this plan. These fees can be either mandatory or voluntary, depending on the specific activity. Mandatory fees could include use of the water dependent activities such as the docks and piers while voluntary contributions could be made at many of the scenic overlooks and picnic areas.

The implementation of a plan will require support from the public in Groton and the leadership of the Town government. The changes which need to be made are bold, but are necessary if existing resources are to be enhanced to meet the needs of the public.

Chapter VI

RECOMMENDATIONS AND CONCLUSIONS

The Thames River study has revealed that there are feasible alternatives which can be implemented to enhance the access and use of the study area shoreline. The river has been an active location for commerce and has the potential for serving increased tourist and recreational demands. It has been demonstrated in other northeast locations (Boston, Massachusetts; Portland, Maine; and Southern Rhode Island) that coastal-oriented activities become successful when there is a careful integration of resources with the existing infrastructure. By building and capitalizing on existing conditions, a tremendous stimulus can be achieved to change and improve an area.

Dredge containment was envisioned at the onset of the study to be a viable process to enhance the usefulness of the study area. However, after careful assessment of the channel it proved that there are not many desirable locations to conduct this type of modification. Further through coordination with the Army Corps of Engineers, it was found that there are no eminent plans for dredge containment along this shoreline area.

The study has concluded that the following actions should be considered:

1. Improvements to width profile, shoulders and signage should be made to Military Highway to enhance access along the study area. Traffic safety improvement would be necessary to handle increased traffic flow generated by the Nautilus Memorial, Thames Street Development and develop-ent along the study area.

2. A phased development should be planned. Minor improvements of a passive recreational nature (overlooks and trails) should be advanced. Major development (parking areas, boardwalk, fishing pier and docks) should be fully evaluated for potential impacts and constructed in conjunction with Thames Street and Nautilus Memorial Development;

3. Active liaison efforts should be maintained with the Providence and Worcester Railroad to assist in the planning of railroad related development options (excursion trains), possible funding assistance, land acquisition or easements, and to design safety measures to protect pedestrians from gaining access to the tracks;

4. Close coordination with the City of Groton will help to unite the area with Thames Street and the Nautilus Memorial creating a new theme along the river. A joint committee should be established to develop strategies for implementation of the Thames River and Thames Street plans, including, but not limited to; parking facility improvement on Bridge and Buell Street; acquisition, easements or joint implementation of development near Whaling City to provide parking, access, and boat launching facilities; pursue the planning, funding, and scheduling of a public or private shuttle bus service from Thames Street along Military Highway to the Nautilus Memorial; encourage the private development of a water taxi or river tour business to provide access to and highlight the river front development in

both the City and the Town and to include possible ferry service to the New London side of the Thames River. The committee should include representatives from the Zoning Board, Planning Board, Nautilus Memorial Development Commission, and the Thames Street Development Commission;

5. The Town should take necessary measures to ensure zoning above the study area remains low density residential. The study area should be designated waterfront recreational/open space;

6. Ultimate use of the study area should be restricted to passive recreation and limited active water dependent activities such as jogging trails, picnic areas, overlooks, small docks, and a fishing pier(s)

7. A detailed hydrologic study of the area should be completed prior to permitting use of the box culvert as a pedestrian access route.

   The hydrologic study should be used to assist you in developing water control regulations to govern possible runoff increases caused by construction and development. The runoff should be monitored periodically for pollutant loadings during and after construction;

8. Extensive development along the river for commercial uses such as a full service marina are not feasible at this time. Such development would be possible if ample funding were available and proper precautions were taken to protect the environment.

The private sector could desire to undertake this development. However, the high cost, limited development potential, and environmental constraints would hamper such development; and,

9. The Town of Groton should proceed with the development of overlooks and jogging trails to provide passive recreational activities along the Thames River. If and when the Nautilus Memorial is built, additional development of the study area should be undertaken. This development should include a boardwalk, docking facilities, a fishing pier, and a parking facility near Whaling City. Growth along the Thames River waterfront should be monitored to determine the appropriate time and extent of additional development of parking facilities near Bridge and Buell Street.

The Town of Groton can benefit from these improvements and can enhance their share of tourist related business and economic growth. Local use of recreational facilities can be compatible with tourism with sound planning and decision making.

APPENDIX A

UNIT PRICES

Concrete:	Formwork, Purchase Placement Testing, Reinforcement.	$300/CY
Borrow:	Purchase, Place and Grade	$ 3/CY
Asphalt:	4" Binder Course, Surface Course (2") Placement.	$ 24/TON
Gravel Base Course:	Place and Grade 12" Thick	$ 3/CY
Wood Decking and Piers:	Place, Frame 2" x 4" rough Boardwalk Supports, Treated Lumber.	$ 2/SF
Piles:	Furnish and Drive Wooden, 2' diam., 2 piles/ 10' of Deck, 60' Length.	$ 15/LF
Pedestrian Overpasses:	Deck, Substructure, Rail, Steps, etc.	$ 10/SF
Jogging Trail:	Place Gravel Cover, Clear and Grade	$ 3/SY
Picnic Facilities:	Clear, Grade, Seed, Plants, Table, Trash Bins.	$100/SITE
Sidewalks:	5' Width, 6" Thick Concrete, Form, Grade Base, Place, Finish.	$300/CY
Miscellaneous:	Handrails, Signs, Curbing, Plants, Seeding Complexity of Construction, Erosion Control, Mitigation Measures, Clear and Grub.	20%
Contingency:	Engineering 20%, Inflation 5%, Contractor 10%, 15% Land Acquisition, Administration and Permitting.	50%

SCHEME #1

Retaining Wall at Overlooks		
5' W x 10' H x 620' L/27 x $300/CY	=	$344,444
Asphalt at Overlooks		
12,000 SF x 0.5' thick x 150lb/SF ÷ 2000 lb/TON x $24/TON.	=	10,800
Gravel Base Course 12,000 SF x 1' thick/27 x $3/CY	=	1,333
Borrow		
30,400 CY x $3/CY	=	91,200
Sidewalk at Overlooks		
6" thick x 560' L/27 x $300/CY	=	3,111
Wooden Deck		
3200 Bd Ft x $2 /Bd Ft	=	6,400
Picnic Facilities		
Clearing, Planting, Seeding, Grading, Tables, Trash Bins. $100/Site x 14 Sites	=	1,400
Jogging Trail		
Clear and Grade, 6,200' L x 5' W/9x3/54	=	10,333
Gravel Cover, 6,200' L x 5' W x0.5' Deep/27 x $3/CY	=	1,722
SUBTOTAL	=	$470,743
Miscellaneous Items + 20%	=	94,149
Contingency + 50%	=	282,446
TOTAL	=	$847,338

SCHEME #2

Retaining Wall at Overlooks	
620 LF x 10' H x 5' W/27 x $300/CY	= $344,444
450 LF x 15' H x 5' W/27 x $300/CY	= 375,000
Borrow 76,950 CY x $3/CY	= 230,850
Asphalt 21,460 SF x 0.5' thick x 150 lb/CY ÷ 2000 $\frac{lbs}{TON}$ x $\frac{\$24}{TON}$	= 19,314
Gravel Base	
21,460 SF x 1" thick/27 x $3/CY	= 2,384
Wood Deck and Boardwalk	
45,150 SF x $2/SF	90,300
Overpasses	
2 at 5000 Bd Ft x $10/Bd Ft	= 100,000
Jogging Trail	
Grade and Clear 10,400 LF x 5' W/9 x $3/SY	= 17,333
Gravel 10,400 LF x 0.5' thick x 5'W/27 x $3/CY	= 2,889
Sidewalk 905' L x 5'W x 0.5' D/27 x $300/CY	= 25,139
SUBTOTAL	= $1,207,653
Miscellaneous + 20%	= $ 241,531
SUBTOTAL	= $1,448,184
Contingency + 50%	= $ 724,092
TOTAL	= $2,172,276

SCHEME #3

Scheme #2	=	$1,207,653
Plus Floating Docks		
Deck 2 at 70' L x 5' x $2/SF	=	1,400
2 at 100'L x 10'W x $2/SF	=	4,000
Piling 2 at 20 Piles x 60' L x $15/LF	=	36,000
2 at 14 Piles x 60' L x $15/LF	=	25,200
Fishing Pier		
Deck 100' L x 10' W x $2/SF	=	2,000
Piles 100' L/10 x 2 x 2 x 60' L x $15/LF	=	36,000
Extra Trails		
Gravel 680' L x 5' W x 0.5' Deep/27 x $3/CY	=	189
Clear and Grade 680' L x 5' w/9 x $3/SY.	=	1,133
Extra Picnic Facilities		
5 at $100		500
SUBTOTAL		$1,314,075
Miscellaneous + 20%	=	162,815
SUBTOTAL	=	$1,476,890
Contingency + 50%	=	738,445
TOTAL	=	$2,215,335